



D8.2: Green airport project certification (handbook)

Grant Agreement number: 101036871

Project acronym: OLGA

Project title: HOListic & Green Airports

Funding scheme: Innovation Action (IA)

Start date of the project: 1st October 2021

Duration: 60 months

Project coordinator: Virginie Pasquier, Project Manager Environment / Energy, ADP

Tel: +33 7 88 35 16 07

E-mail: virginie.pasquier@adp.fr

Project website address: www.olga-project.eu

OLGA project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement n° 101036871

THIS DOCUMENT CONTAINS INFORMATION, WHICH IS PROPRIETARY TO THE OLGA CONSORTIUM. NEITHER THIS DOCUMENT NOR THE INFORMATION CONTAINED HEREIN SHALL BE USED, DUPLICATED OR COMMUNICATED BY ANY MEANS TO ANY THIRD PARTY, IN WHOLE OR IN PARTS, EXCEPT WITH THE PRIOR WRITTEN CONSENT OF THE OLGA CONSORTIUM. THIS RESTRICTION LEGEND SHALL NOT BE ALTERED OR OBLITERATED FROM THIS DOCUMENT.



DOCUMENT INFORMATION

Document Name	Green airport project certification (handbook)
Version	V2
Version date	22/07/2026
Authors	Victor Robin (BV), Diego Ratazzi (RINA), Florent Huet (CRIGEN), Radu Mirea (COMO), Delia Dimitriu (COMO)
Security	Public

APPROVALS

	Name	Company	Date	Visa
Coordinator	Virginie PASQUIER	Groupe ADP	07/07/2026	OK
WP Leader	Delia Dimitriu	COMO	30/03/2026	OK
Task Leader	Delia Dimitriu	COMO	30/03/2026	OK
Quality Manager	Melike RIOLLET	LUP	08/07/2026	OK

DOCUMENT HISTORY

Version	Date	Modification	Authors
V0	11/03/2026	Initial version	VR/DR/FH
V01	24/03/2026	Updated version	VR/DR/FH/RM/DD
V02	30/03/2026	Final draft	VR/DR/FH/RM/DD
V03	04/07/2026	Comments incorporated	VR/DD
V04	15/06/2026	Coordinator review and comments	VP



V05	06/07/2026	Edited version	DD
V1	08/07/2026	Quality review	MR
V2	15/07/2026	Further revisions	VR



Table of Contents

<u>1 INTRODUCTION</u>	9
1.1 OLGA PROJECT	9
1.2 WORK PACKAGES	9
1.3 PURPOSE OF THE MANUAL	10
1.4 TASKS ADDRESSED	11
<u>2 KEY SUSTAINABILITY DOMAINS FOR AIRPORTS</u>	11
2.1 ENERGY EFFICIENCY & RENEWABLE ENERGY	13
2.2 PASSENGER AND EMPLOYEE TRANSPORT	14
2.3 CONSTRUCTION	14
2.4 WATER AND WASTE MANAGEMENT	14
<u>3 IMPORTANCE OF GREEN CERTIFICATION IN AVIATION</u>	15
3.1 A WAY TO COMBINE COMPLIANCE, REPUTATION, COST SAVINGS AND CLIMATE GOALS	15
3.2 CERTIFICATIONS, LABELS AND STANDARDS: HOW TO DIFFERENTIATE THEM	15
<u>4 STEPS TO ACHIEVE CERTIFICATION</u>	16
4.1 BASELINE ASSESSMENT	17
4.2 GAP ANALYSIS VS. CERTIFICATION REQUIREMENTS	17
4.3 ACTION PLANNING	17
4.4 IMPLEMENTATION	17
4.5 MONITORING & REPORTING	17
4.6 CERTIFICATION APPLICATION & AUDIT	18
<u>5 OVERVIEW OF CERTIFICATION SCHEMES RELEVANT TO AIRPORTS</u>	18
5.1 AIRPORT CARBON ACCREDITATION (ACA, ACI EUROPE/WORLD)	18
5.2 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED)	20



5.3	BUILDING RESEARCH ESTABLISHMENT ENVIRONMENTAL ASSESSMENT METHOD (BREEAM).....	21
5.4	ISO STANDARDS: ISO 14001 (ENVIRONMENTAL MANAGEMENT), ISO 50001 (ENERGY MANAGEMENT).....	22
5.5	OTHER FRAMEWORKS: EU TAXONOMY, CORSIA	23
6	<u>1ST LEVER STUDIED IN OLGA : WASTE-TO-BIOFUEL CERTIFICATION FOR ONSITE VEHICLES</u>	<u>23</u>
6.1	AIRPORTS PRESENTATION AND INPUT DATA.....	24
6.2	CRIGEN – WASTE-TO-BIOFUEL PROJECT – INPUT FOR THE SCHEME CRITERIA	29
6.3	WASTE-TO-BIOFUEL ORIGIN CERTIFICATION SCHEME – CRITERIA.....	32
6.4	WASTE-TO-BIOFUEL ORIGIN CERTIFICATION SCHEME – GOVERNANCE	38
7	<u>2ND LEVER : SUSTAINABLE AVIATION FUELS (SAF) CERTIFICATION FOR AIRCRAFTS.....</u>	<u>40</u>
7.1	DEFINITION OF SAF.....	41
7.2	CERTIFICATION FOR SAF	41
7.3	SAF FOR CORSIA	42
7.4	SAF FOR ReFUELEU AVIATION	43
7.5	STANDARD FOR SAF IN AIRPORTS	44
8	<u>3RD LEVER : “H2 READY” AIRPORT STANDARD</u>	<u>45</u>
8.1	CERTIFICATION FOR H2 FOR AIRCRAFTS AND ONSITE VEHICLES	45
8.2	STANDARDS FOR THE AIRPORTS	46
8.3	MASTERPLAN FOR H2-READY AIRPORTS (FROM OLGA D5.3 [8])	46
8.4	HYDROGEN SUPPLY-CHAIN ARCHITECTURES FOR AIRPORTS	48
9	<u>INTERACTION OF THE THREE CERTIFICATION LEVERS WITH EXISTING AIRPORT CERTIFICATIONS</u>	<u>49</u>
9.1	MODIFYING EXISTING CERTIFICATIONS TO INCLUDE NEW CRITERIA.....	50
9.2	CREATING SEPARATE CERTIFICATION SYSTEMS	51
9.3	UNIFIED CERTIFICATION UNDER EUROPEAN COMMISSION OVERSIGHT	51



10 IMPLEMENTATION, ROADMAP & CONTINUOUS IMPROVEMENT	52
10.1 IMPLEMENTATION OF CERTIFICATION SCHEMES	52
10.2 SHORT-TERM (1–3 YEARS):	53
10.3 MEDIUM-TERM (3–7 YEARS):	53
10.4 LONG-TERM (7–15 YEARS):	53
10.5 KEY PERFORMANCE INDICATORS (KPIs) FOR THE IMPLEMENTATION OF CERTIFICATION SCHEMES	54
11 TOOLS AND BEST PRACTICES	57
11.1 ENERGY MANAGEMENT SYSTEMS (EMS)	58
11.2 ENVIRONMENTAL MANAGEMENT SYSTEM (ENMS)	58
11.3 DIGITAL TWINS FOR AIRPORT OPERATIONS	58
11.4 GREEN PROCUREMENT POLICIES	58
11.5 EXAMPLES	58
12 CONCLUSION	59
13 REFERENCES & RESOURCES	60

List of Figures

Figure 1 : OLGA project Work Packages	9
Figure 2 : Representation of an airport emissions through different scopes	12
Figure 3 : Large airport CO2 emissions	13
Figure 4 : Standard ISO	16
Figure 5 : Airport Carbon Accreditation levels of accreditation	19
Figure 6 : Example of certificate, Chambéry Airport's ACA Certificate	20
Figure 7 : Example of certificate, Antalya Airport's LEED Certificate	21
Figure 8 : Example of certificate, BREEAM Certificate for a new construction	22
Figure 9 : Decarbonation strategy of Zagreb airport	25



Figure 10 : CRIGEN waste-to-biofuel production pathway (source : Crigen, 2024)	32
Figure 11 : Waste hierarchy according to WFD	34
Figure 12 : Traceability all along the supply chain (source : ISCC System documents, ISCC EU 203 V4.0)	37
Figure 13 : Example of Proof of Sustainability (PoS)	37
Figure 14 : Possible governance for the waste-to-biofuel certification scheme	39
Figure 15 : ReFuelEU's target for 2050	42
Figure 16 : ASTM logo	44
Figure 17 : SAE logo	46
Figure 18 : Steps of H2-ready airport masterplan	48
Figure 19 : Supply chains for H2-ready airports	49

List of Tables

Table 1 : Fuels and their standards	35
---	----

List of Abbreviations

ACA	Airport Carbon Accreditation	HVO	Hydrotreated vegetable oil
ACI	Airports Council International	HVAC	Heating, Ventilation, and Air Conditioning
ACU	Air Conditioning Unit	ICAO	International Civil Aviation Organization
ADP*	Aéroport de Paris (Airport of Paris)	ISCC	International Sustainability and Carbon Certification
ASU	Air Starter Unit	ISO	International Organization for Standardization
ASTM	American Society for Testing & Materials	KPI	Key Performance Indicator
BREEAM	Building Research Establishment Environmental Assessment Method	LCA	Life-cycle assessment



BV	Bureau Veritas	LEED	Leadership in Energy and Environmental Design
CAPEX	Capital Expenditure	LH2	Liquid Hydrogen
CB	Certification Bodies	LHV	Lower Heating Value
CDG*	Paris-Charles de Gaulle Airport	LNG	Liquefied natural gas
CH₄	Methane	MXP*	Malpensa airport
CHP	Combined Heat and Power	OLGA	hOLListic & Green Airports
CJL*	Cluj Airport	OMS	Operation Management System
CNG	Compressed natural gas	PSA	Pressure Swing Adsorption
CO₂	Carbon dioxide	RED	Renewable Energy Directive
EC	European Commission	RFFS	Rescue and FireFighting Services
EMAS	Eco-Management and Audit Scheme	RFID	Radio Frequency Identification
EMS	Energy Management System	RFNBO	Renewable Fuel of Non-Biological Origin
EnMS	Environmental Management System	RSB	Roundtable on Sustainable Biomaterials
EN	European Norm	SAF	Sustainable Aviation Fuel
ESG	Environmental, Social and Governance	SERA	Standardised European Rules of the Air
EU	European Union	SMS	Safety Management System
GHG	Greenhouse gas	WP	Work Package
GPU	Ground Power Unit	WPL	Work Package Leader
H2	Hydrogen	ZAG*	Zagreb airport
H2020	Horizon 2020		



1 Introduction

1.1 OLGA Project

The **OLGA (hOlistic & Green Airports)** project is a European initiative aimed at accelerating the environmental transition of the aviation sector. Launched under the Horizon 2020 research and innovation program, OLGA brings together a consortium of major stakeholders such as airports, airlines, engineering and consulting entities, operators, research institutions, and public authorities, to develop and implement several innovative solutions for reducing the environmental impact of airport operations.

The project is coordinated by **Groupe ADP (Aéroports de Paris)** and focuses on Paris-Charles de Gaulle Airport as one of the pilot sites, along with **Zagreb Franjo Tudman Airport**, **Milano Linate airport**, and **Cluj Airport**. OLGA's main goal is to achieve significant reductions in greenhouse gas emissions, improve energy efficiency, promote sustainable mobility, and enhance the overall environmental performance of airports.

1.2 Work Packages

The OLGA project is divided into ten Work Packages (WP) as presented below:

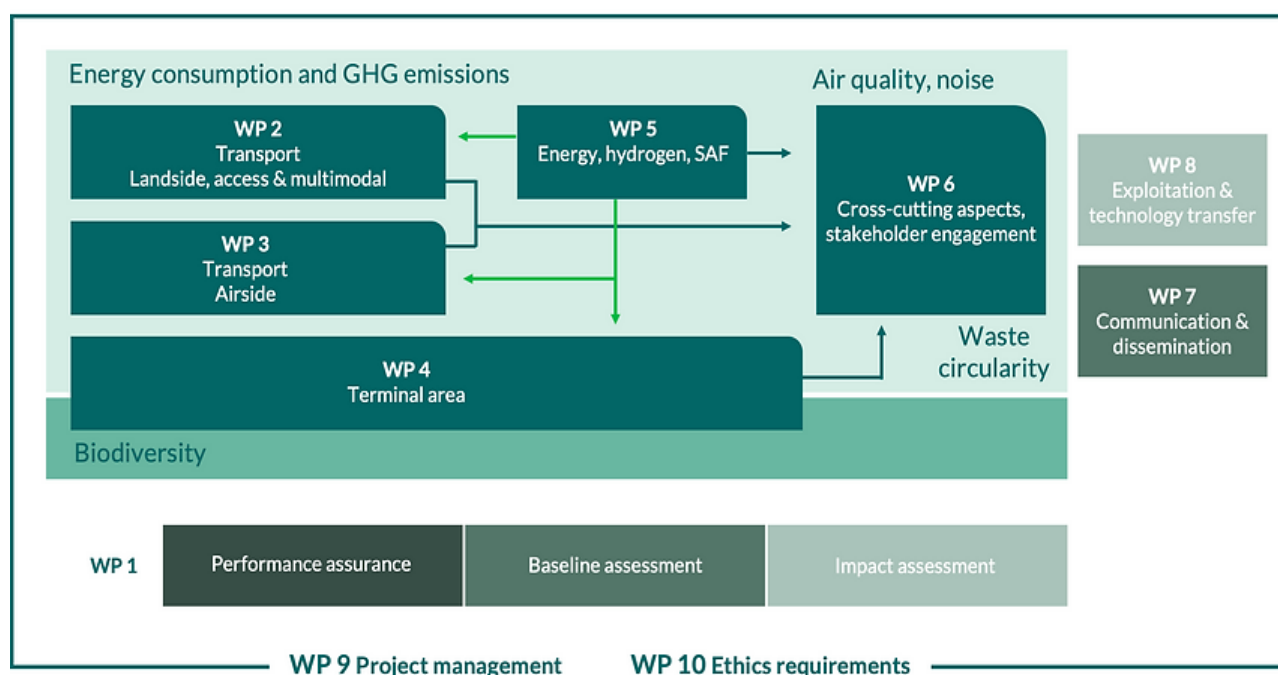


Figure 1 : OLGA project Work Packages



Every Work Package has a different subject, different objectives and includes different actors. Two WP (WP1 and WP8) are mentioned in this report. They are summarized below:

- WP 1 – Baseline and impact assessment – Led by Bureau Veritas

Objectives: This work package ensures the relevance, quality and reliability of impact assessments across the project. It will support the replication process to assess the environmental impacts of green airport solutions for landside transport, airside transport, terminal and energy.

- WP 8 – Exploitation and technology transfer – Led by Comoti

Objectives: This work package is responsible for optimising the use of results and ensuring technology transfer to users (airport community). It will define an exploitation strategy and roadmap for the results generated by OLGA and build a coherent action plan for implementation & impact during and after the project.

The WP 8 is also divided into four sections as presented below

- › WP 8.1: Intellectual Property Rights (IPR), Exploitation and Certification
- › WP 8.2: New business models and Cost Benefit Analysis
- › WP 8.3: Technology Transfer
- › WP 8.4: Training to support the exploitation of OLGA results

Subtask WP8.1.2: Green Energy at Airport - project certification led by BV has conducted a consistent analysis on airport green certification, providing and examining several examples, defining audit criteria, and issuing certification rules as part of a Manual which represents D8.2 Green airport project certification.

1.3 Purpose of the Manual

The main purpose of this manual is to guide airports towards sustainability and net-zero through the implementation of the results and technology transfer from the OLGA project, with a particular focus on certification. The manual will provide a clear exploitation strategy and roadmap, as well as a coherent action plan for implementation and impact.

The manual will provide detailed information on the importance of green certification in aviation and the steps required to achieve certification. It will also provide an overview of relevant certification schemes for airports, including Airport Carbon Accreditation (ACA), LEED, BREEAM, ISO standards (ISO 14001, ISO 50001), and other frameworks such as EU Taxonomy and CORSIA.

Additionally, the manual will propose three specific certification schemes relevant to airports: Waste-to-Biofuel Certification, Sustainable Aviation Fuels (SAF) Certification, and "H2 Ready" Airport Standard. Each proposition will include a detailed description of the certification criteria and governance.



This report is the first version of the deliverable D8.2 Green airport project certification. It addresses

- › Leads for Green Airport Certification
- › Waste-to-biofuel certification scheme for land vehicles
- › Interaction with the use of SAF
- › Interaction with the use of H2

This manual is one of OLGA's WP8.1.2 deliverable, and expected to be submitted in March 2026 (M54).

1.4 Tasks addressed

As mentioned above, this manual addresses an expected deliverable, related to the second part of WP 8.1:

WP8.1.2: Green Energy at Airport - project certification

- i. Develop a Green H2 ready airport standard, based on checklists from task 5.2. (ADP)
- ii. Develop a Waste to biofuel Origin certification scheme, based on standard (checklists) from tasks 2.5 and 5.1 (from other WP) Inputs from different WPs: ADP's H2 design (eventually incomplete if IP protected), CRIGEN's waste to biofuel value chain, WP1 impact assessment method, etc. BV performs a completeness & consistency analysis, defines audit criteria, and issues certification rules (including requirements applying to certification body and auditors' qualification). Training to qualify auditors at airports will be conducted, so they may perform a certification audit at airport.
- iii. Certification ensures that environmental, performance and safety stakes are managed according to best practices and regulations. This is an essential tool to build confidence between stakeholders, including follow-on financing.

2 Key Sustainability Domains for Airports

Airports are significant contributors to greenhouse gas emissions, and reducing these emissions is essential for mitigating the impacts of climate change. Airports can measure and track their emissions across all three scopes to identify areas for improvement and set reduction targets.

- Scope 1 emissions come from sources that are owned or controlled by the airport, such as airport-owned vehicles or on-site power generation.
- Scope 2 emissions come from the generation of purchased electricity, heat, or steam.
- Scope 3 emissions come from sources that are not owned or controlled by the airport but are related to its activities, such as emissions from employee commuting or airline fuel consumption.



An airport's carbon footprint comprises emissions that are within and outside of its control



Graphic sourced from ACA "Short Guide to Airport Carbon Accreditation"
<https://www.airportcarbonaccreditation.org/airport/technical-documents.html>



Figure 2 : Representation of an airport emissions through different scopes

Carbon neutrality pathways can be achieved by purchasing renewable energy credits, investing in carbon offset projects, and implementing energy-efficient technologies.

Most emissions of an airport come from scope 3 emissions and aircraft operations, as presented by the study below.



Scope 3 emissions account for >90% of an airport's footprint, largely made of aircraft ops, passenger & employee transport

Airport emissions by source for large, advanced airports¹

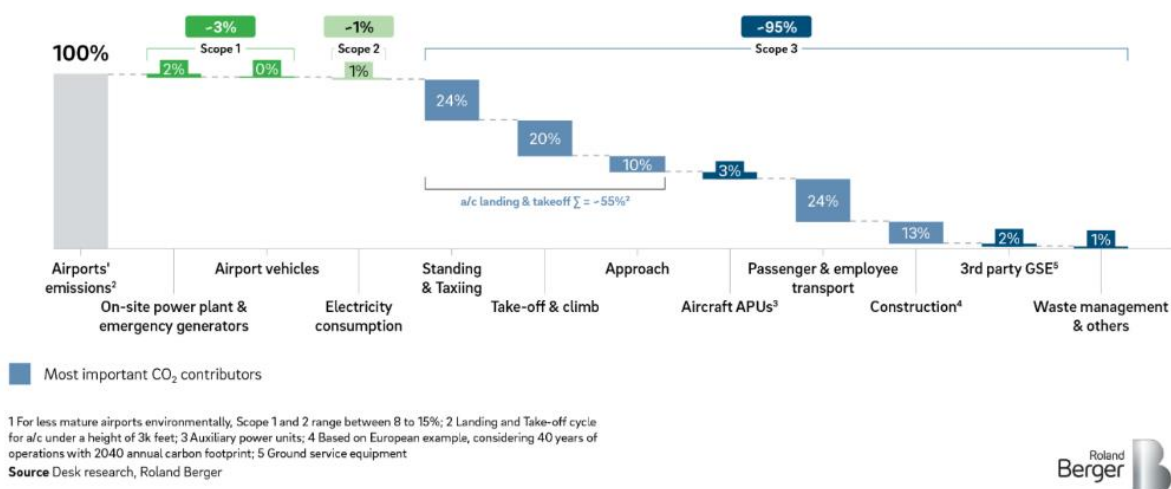


Figure 3 : Large airport CO2 emissions

2.1 Energy Efficiency & Renewable Energy

Energy use in airport operations (especially aircraft standing and taxiing, which accounts for 24% of scope 3 emissions) is an important contributor to greenhouse gas (GHG) emissions, and improving energy efficiency and increasing the use of renewable energy sources can help to reduce these emissions and lower operating costs.

- Terminal building energy management is one area where airports can make improvements. Implementing energy-efficient lighting, heating, and cooling systems can significantly reduce energy consumption in terminal buildings.
- Additionally, airports can install on-site renewable energy systems such as solar panels, wind turbines, or biomass generators to produce clean electricity and reduce reliance on fossil fuels.
- Electrification of ground support equipment is another way to decarbonize airport operations. Replacing traditional fossil fuel-powered ground support equipment with electric alternatives (electric towing) can reduce emissions and lower operating costs.



2.2 Passenger and employee transport

Transportation is a significant contributor to GHG emissions (24%), and airports can have a hand on reducing these emissions by encouraging sustainable transportation options for passengers and employees.

- Encouraging sustainable transportation modes such as public transportation, cycling, or carpooling can reduce the number of single-occupancy vehicles traveling to and from the airport.
- Providing electric vehicle charging stations can ease and encourage the use of electric vehicles and reduce emissions from transportation.

2.3 Construction

Construction activities at airports can also contribute to GHG emissions (13%). However, airports can take steps to reduce these emissions and promote sustainable construction practices.

- Implementing a green building design and construction policy can help to ensure that new buildings and infrastructure are designed and constructed to minimize emissions and promote sustainability.
- Using sustainable building materials, such as recycled or locally sourced materials (e.g. Oslo airport).
- Incorporating green spaces and vegetation into airport design can help to sequester carbon and promote biodiversity.

2.4 Water and Waste Management

Water and waste management are crucial domain, and taking care of them can help to lower the emissions produced.

- Airports can collect and store rainwater for use in non-potable applications such as irrigation and toilet flushing. This can help to reduce the demand for freshwater and lower operating costs.
- Additionally, airports can treat and reuse wastewater for non-potable applications, such as cooling towers, vehicle washing, and landscape irrigation. This can further reduce the demand for freshwater and provide a reliable water source during periods of drought or water restrictions.
- Implementing circular economic approaches such as reuse, recycling, and composting can reduce waste and lower emissions by reducing the need for raw materials and the energy required for extraction, processing, and manufacturing.



3 Importance of green certification in aviation

3.1 A way to combine compliance, reputation, cost savings and climate goals

Green certification in aviation is becoming important as industry wants to reduce its environmental impact and meet climate goals. By obtaining green certification, airports and airlines can demonstrate their compliance with environmental regulations, enhance their reputation as environmentally responsible organizations, achieve cost savings, and meet their climate goals.

Compliance and green certification go hand in hand, as certification can help airports and airlines comply with regulations and standards related to environmental performance. This can include regulations related to emissions and the domains that we tackled in the paragraphs Key Sustainability Domains for Airports, namely the energy efficiency, the water management, or the waste management.

The reputation of airports and airlines is also of significant importance. By obtaining green certification, they can put forward their reputation as environmentally responsible organizations, which can help to attract customers, investors, and partners who value sustainability. Since the aviation sector is regularly subject to criticism regarding greenwashing and is recognized as one of the sectors bearing responsibility for climate change (as exemplified by flygskam in Nordic countries), it is essential for stakeholders to implement appropriate measures to safeguard their reputation.

Cost savings are also a significant benefit of green certification. By implementing sustainable practices and technologies, airports and airlines can reduce their energy and water consumption, lower their waste disposal costs, and improve their overall efficiency. Green certification can help airports and airlines identify opportunities for cost savings, which can help to lower operating costs and improve financial performance.

Finally, green certification can help airports and airlines meet their climate goals and reduce their carbon footprint. This can include setting targets for emissions reductions, implementing renewable energy projects, and implementing sustainable transportation options.

3.2 Certifications, labels and standards: how to differentiate them

Certification

Certification is a procedure by which a third party gives written assurance that a product, process, or service is in conformity with certain standards. Certification can be seen as a form of communication along the supply chain, and the certificate demonstrates to the buyer that the supplier complies with certain standards.

Certification process is based on rigorous audits and assessments conducted by experienced and impartial auditors, and the company is accredited by various national and international organizations, such as the United Kingdom Accreditation Service (UKAS), the American National Standards Institute (ANSI) or the French Accreditation comity (COFRAC).



Certifications can provide a more robust and rigorous assessment of an organization's capabilities and performance compared to a simple label. However, the certification process is often less flexible and can create a higher degree of commitment or obligation, making it more challenging.

Label

A label is a mark or symbol that indicates that a product or service meets certain criteria or standards. The use of the label is usually controlled by the standard-setting body. The label must be meaningful to be effective in communication with the end consumer.

It is, however, essential to consider the credibility and reliability of the organization responsible for creating and managing a label. A sudden change in the creator of a label, such as a merger or acquisition, can impact the label's value and reputation, thus compromising the projects.

Compared with the certification, the label is not acknowledged by state entities or require state approbation, but the label rules are more flexible.

Standard

Standards are defined by ISO as documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions, to ensure that materials, products, processes, and services are fit for their purpose.

Standards are essential for ensuring the quality, safety, and performance of materials, products, processes, and services. They provide a clear framework for ensuring that criteria are met and are fit for their intended purpose. While setting international standards can be challenging, normative standards can provide a useful framework for local standard-setting or certification bodies to develop more specific standards.

Certification and label systems can rely on ISO standards to define their rules. They are internationally acknowledged and are defined by rigorous technical committees.



Figure 4 : Standard ISO

4 Steps to achieve certification



4.1 Baseline Assessment

The baseline assessment is the first step towards achieving certification. It involves conducting complete audits (including energy, carbon footprint or waste and water impact) to understand the airport's current environmental impact. This assessment should include a review of the airport's existing infrastructure, operations, and policies. The purpose of the baseline assessment is to identify areas for improvement and set targets for reducing the airport's environmental impact. The assessment should be conducted by a qualified sustainability consultant or auditor.

4.2 Gap Analysis vs. Certification Requirements

The second step is to conduct a gap analysis to compare the airport's current practices with the requirements of the chosen certification scheme, such as ACA, LEED, BREEAM, or ISO. This involves reviewing the certification criteria and identifying any gaps between the airport's current practices and the requirements. The gap analysis should also identify any regulatory requirements that the airport must comply with. The purpose of the gap analysis is to develop a clear plan for meeting the certification requirements.

4.3 Action Planning

The third step is to develop an action plan to address the gaps identified in the gap analysis. This includes setting targets for reducing the airport's environmental impact and defining Key Performance Indicators (KPIs) to measure progress towards these targets. The action plan should also include a timeline for implementation and identify any necessary resources or investments. The action plan should be developed in consultation with stakeholders, including airport staff, tenants, and passengers.

4.4 Implementation

The fourth step is to implement the action plan. This means changing the necessary aspects that need are concerned by the specific certification. For a green certification this can include upgrading green infrastructure, such as installing energy-efficient lighting, HVAC systems, and renewable energy sources, as well as implementing waste reduction and water conservation measures. It can also include training staff and engaging stakeholders in sustainability initiatives. Implementation should be carried out in a systematic and planned manner, with regular progress reports provided to stakeholders.

4.5 Monitoring & Reporting

The fifth step is to monitor progress towards sustainability targets and report on progress regularly. This includes using data management systems to track energy use, water consumption, waste



generation, and carbon emissions. By monitoring progress, airports can identify areas for improvement and adjust their action plan as needed. Regular reporting also helps to ensure transparency and accountability. Monitoring and reporting should be carried out in accordance with the airport's chosen certification scheme.

4.6 Certification Application & Audit

The final step is to prepare the certification application and undergo a third-party verification audit. This involves preparing documentation to demonstrate compliance with the certification criteria and undergoing an audit by an independent third-party verifier. The audit may include a review of the airport's infrastructure, operations, and policies, as well as interviews with staff and stakeholders. By successfully completing the audit, airports can achieve certification and demonstrate their commitment to sustainability. It is important to note that certification is not a one-time event but requires ongoing monitoring and reporting to maintain certification status.

5 Overview of certification schemes relevant to airports

Airport certification schemes are important tools for ensuring that airports meet certain standards for environmental management, energy management, and carbon reduction. This section will focus on various certification schemes that are relevant to airports. These schemes play a crucial role in ensuring that airports meet specific standards for environmental management, energy management, and carbon reduction. Here are some of the most significant certification schemes for airports:

5.1 Airport Carbon Accreditation (ACA, ACI Europe/World)

The Airport Carbon Accreditation [4] program is a global certification program for airports that aims to reduce carbon emissions. The program has five levels of accreditation that we can see on Figure 5:

- **Level 1: Mapping** - Determine operational boundary and calculate annual carbon emissions for Scope 1 and 2 sources.
- **Level 2: Reduction** - Implement carbon management procedures, reduce carbon footprint, and provide evidence of effective procedures.
- **Level 3: Optimization** - Widen the scope of carbon footprint to include Scope 3 emissions and provide evidence of engagement with third-party operators to reduce emissions.
- **Level 4: Transformation** - Commit to absolute emissions reduction, form a long-term reduction target, and engage stakeholders to reduce emissions.



- **Level 5: Topmost Level of Airport Carbon Accreditation** - Achieve net-zero emissions by reducing Scope 1, 2, and relevant categories of Scope 3 emissions through credible carbon removals and offsetting any residual emissions.

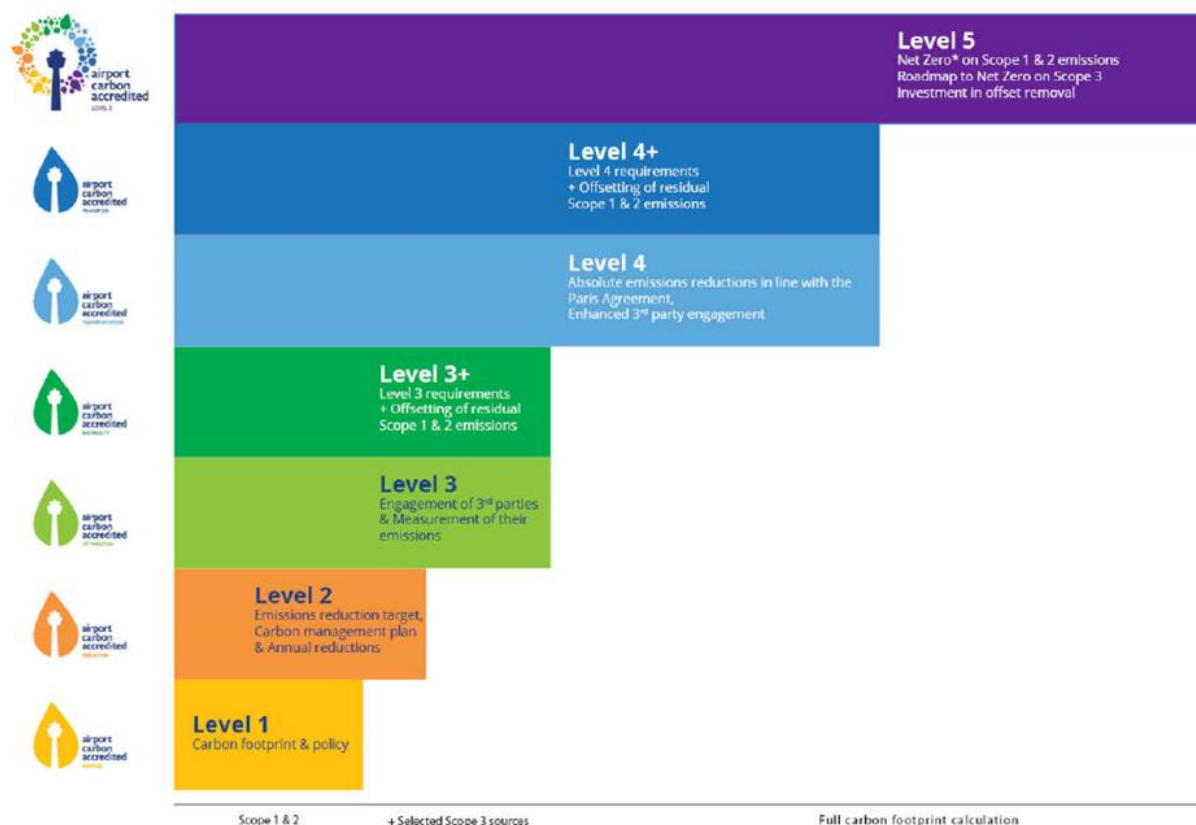


Figure 5 : Airport Carbon Accreditation levels of accreditation



Figure 6 : Example of certificate, Chambery Airport's ACA Certificate

Airports can achieve accreditation by measuring and reporting their carbon emissions, implementing carbon management plans, and taking steps to reduce their carbon footprint.

5.2 Leadership in Energy and Environmental Design (LEED)

LEED [5] is a certification program for green buildings that is administered by the U.S. Green Building Council. While LEED is not specifically designed for airports, many airports have used the program to certify their terminal buildings (e.g. San Francisco International Airport (SFO), Indira Gandhi International Airport in New Delhi, Denver International Airport (DEN)).

LEED has several rating systems, including building design and construction, interior design and construction, operations and maintenance.



Figure 7 : Example of certificate, Antalya Airport's LEED Certificate

5.3 Building Research Establishment Environmental Assessment Method (BREEAM)

Similar to LEED, BREEAM [5] is a certification program for sustainable buildings that is administered by the Building Research Establishment in the UK. Like LEED, BREEAM is not specifically designed for airports, but many airports have used the program to certify their terminal buildings (e.g. Oslo Airport Terminal 2, Heathrow South Cargo Centre). BREEAM has several rating systems, including new construction, refurbishment, and in-use.

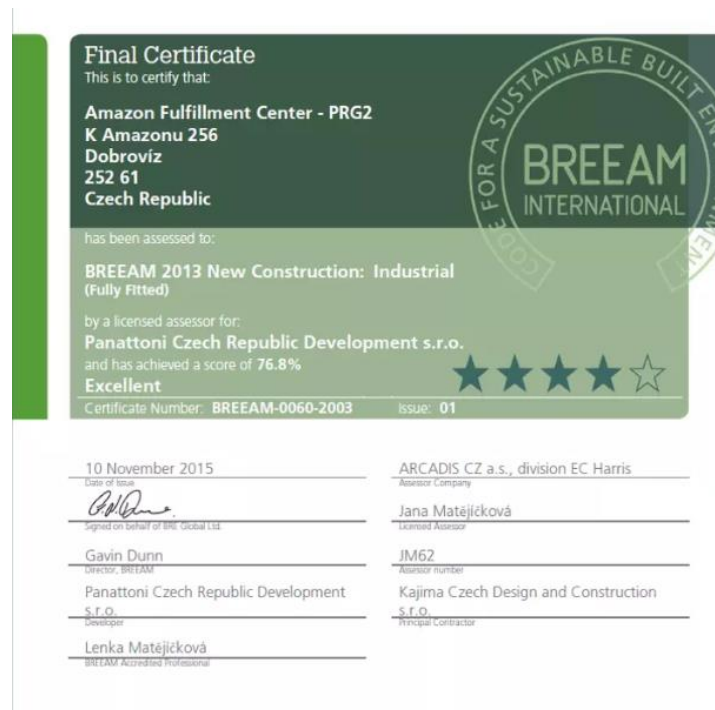


Figure 8 : Example of certificate, BREEAM Certificate for a new construction

5.4 ISO Standards: ISO 14001 (Environmental Management), ISO 50001 (Energy Management).

ISO 14001 and ISO 50001 [6] are two very well-known international standards that provide a framework for airports to manage their environmental and energy impact, respectively.

ISO 14001 is an international standard for environmental management that helps organizations identify, manage, and control their environmental impact. The standard provides a framework for airports to manage their environmental responsibilities in a systematic manner, and it is applicable to all types and sizes of airports. The standard is based on the Plan-Do-Check-Act (PDCA) model, which provides a cyclical approach to managing environmental responsibilities. By implementing ISO 14001, airports can reduce their environmental impact, improve their sustainability, and demonstrate their commitment to environmental management.

ISO 50001 is an international standard for energy management that provides a framework for airports to manage their energy use and improve their energy efficiency. The standard is also based on the PDCA model and provides a systematic approach to managing energy use. By implementing ISO 50001, airports can reduce their energy costs, improve their energy efficiency, and reduce their greenhouse gas emissions. The standard is applicable to all types and sizes of airports and can be integrated with other management systems, such as ISO 14001.



5.5 Other frameworks: EU Taxonomy, CORSIA

The **EU Taxonomy** is a European classification system for sustainable activities that can help airports identify environmentally sustainable investments. The taxonomy includes a list of economic activities that can make a contribution to climate change mitigation or adaptation and do no significant harm to other environmental objectives. The taxonomy is intended to provide clarity and direction for investors, companies, and policymakers seeking to support sustainable economic activities. Airports can use EU Taxonomy to identify investment opportunities that align with their sustainability goals. The list can be found here :

<https://ec.europa.eu/sustainable-finance-taxonomy/taxonomy-compass>

CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) is a carbon offsetting scheme for international aviation that is administered by the International Civil Aviation Organization (ICAO). While CORSIA is not specifically designed for airports, it can indirectly impact airports by requiring airlines to offset their carbon emissions. CORSIA aims to stabilize carbon emissions from international aviation at 2020 levels by requiring airlines to offset any growth in emissions above 2020 levels.

6 1st lever studied in OLGA : Waste-to-Biofuel Certification for onsite vehicles

Waste-to-biofuel refers to the process of converting organic waste materials into biofuels that can be used to power vehicles. When it comes to waste-to-biofuel certification for onsite vehicles, the WP8 of OLGA has been focused on developing a solution for airport ground vehicles with the help of CRIGEN. The goal is to understand the evaluation criteria for such a certification in order to decarbonize airport ground vehicles.

To do so, it's important to consider the environmental objectives and the specifications of airport vehicles that may require a special certification. By working with four airports (presented in the paragraph Airports presentation and input data), we were able to better understand the context of a waste-to-biofuel certification scheme for airport vehicles.

Once the context is specified, we can present a certification scheme that meets the objectives and takes into account existing systems or regulations. This would involve identifying the specific criteria for evaluating waste-to-biofuel certification and ensuring that the certification is tailored to the unique needs and specifications of airport ground vehicles.

Overall, the goal of waste-to-biofuel certification for airport vehicles is to reduce greenhouse gas emissions and promote sustainable transportation practices in the aviation industry. By working together with industry stakeholders and regulatory bodies, we can develop a certification scheme that meets the needs of airports and supports the transition to a more sustainable future.



6.1 Airports presentation and input data

To present the different specificities of airports, a workshop with all the WP8 members has been organized in Paris on April 29th, 2024. The objective was for the airports to present quality requirements for a biofuel that would be more restrictive than for a common road transport biofuel. This section of the report will focus on the presentation of the different airports taken in consideration.

6.1.1 Cluj Avram Iancu International Airport (CLJ)

Presentation

Cluj Avram Iancu International Airport is the main airport in Transylvania. It serves over 4 million inhabitants within a 200 km radius, with 1 million people able to reach it within one hour, and 2.5 million within two hours. In 2023, Romanian airports registered more than 24.5 million passengers.

The airport features 3 terminal buildings with a combined area of over 29,000 square meters and multiple processing streams for domestic, Schengen, and non-Schengen passengers. The processing capacity is approximately 2.4 million passengers annually. There are 24 check-in counters, 2 runways, 11 taxiways, and 22 aircraft parking positions.

Decarbonization Strategy

Cluj Airport supports the 2050 Net-Zero Carbon Emissions Aviation Goal and has obtained the Airport Carbon Accreditation Level 1 and Level 2. Handling companies are required to use electric-powered equipment not older than 3 years. The airport also **holds ISO 14001:2015 and ISO 9001:2015** certifications.

Ongoing projects include a photovoltaic park, runway extension, use of electric ground equipment, and biogas production from EU research. The airport has implemented LED lighting on terminals, platforms, and taxiways to reduce energy consumption.

Cluj Airport works closely with local authorities, research institutions, and EU partners on sustainability and innovation. It is committed to participating in the Clean Aviation European Partnership and aims to achieve ACI Zero carbon emissions by 2050.

Ground Fleet

The ground fleet includes pushback tractors, de-icing equipment, buses, cars, vans, GPUs, and firefighting vehicles. Most are diesel-powered, though electric vehicles are being integrated. In 2023, the airport consumed 237,421 liters of diesel and 7,658 liters of gasoline. Fuel is stored onsite and managed by airport employees.

Jet fuel is provided by Petrom Aviation, while ground vehicle fuel is supplied by Oscar Downstream LTD. Quality certificates are issued to ensure compliance with standards such as DEF-STAN 91-091 for Jet A1 and SR EN 590:2022 for diesel.



6.1.2 Zagreb Franjo Tudman Airport (ZAG)

Presentation

Zagreb Airport is named after Franjo Tudman, the first President of Croatia. The airport occupies a total area extending over approximately 3.28 km² and it is located around 10 kilometres from Zagreb's city centre. With 3 723 650 passengers in 2023, it is the largest and busiest airport in Croatia. It is the hub of the Croatian flag carrier Croatia Airlines and the main base of the Croatian Air Force.

The catchment area is 4 million passengers and 15 000 t of cargo within 2 hours of driving distance, with category for firefighting CAT 9 and reference code of Franjo Tudman Airport is 4E. There is one primary runway which is 3 252 m long. In 2023, Zagreb Airport served in total of 21 commercial airlines and 62 commercial destinations. There were in total 22 863 operations. The minimum connection time between flights at the Zagreb Airport is 40 minutes.

Decarbonization Strategy

Zagreb Airport has set ambitious targets for reducing internal CO₂ emissions while, at the same time, improving the level of quality of service and considering the growth in airport capacity. The interim target is to reduce CO₂ emissions in scope 1 and scope 2 by 17% from 2022 values in the period from 2023 to 2026.

Until 2030, Zagreb Airport commits to reduce GHG emissions by 50% in respect to 2021 levels. Zagreb Airport is committed to achieve net zero emissions by 2050.

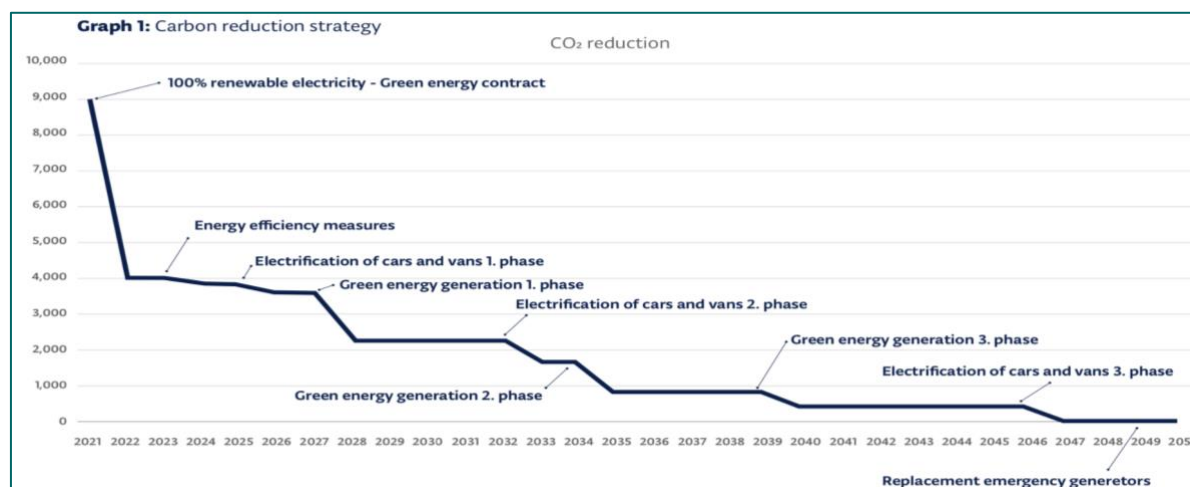


Figure 9 : Decarbonation strategy of Zagreb airport

Ground Fleet

The ground fleet includes vehicles powered by various fuels, with a focus on reducing diesel and petrol usage and increasing electricity and gas usage.

Some special vehicles include:

- Electric vehicles for passengers with disabilities



- De-icer vehicles for de-icing treatment of the aircrafts
- Pushback vehicles for the aircrafts' movement
- Buses for passengers' transport (both diesel and electric)
- Farm tractors for mowing green areas
- Special snow vehicles
- Passengers' stairs
- Ground Power Units (GPUs), Air Conditioning Units (ACU) and Air Starter Units (ASU), all on wheels
- Cargo loaders
- Transporters
- Aircraft refuelling tanks
- Vehicles for handlers' activities (refuelling of water, wastewater disposal, catering, etc.)
- Special fire brigade vehicles
- Tow tractors
- Belt loader unit

All the vehicles listed below operate with conventional internal combustion engines and are therefore compatible with standard liquid biofuels such as biodiesel (FAME) and bioethanol-based blends. As such, they are subject to the same quality and technical requirements that apply to any road vehicle using biofuels. To be safely and effectively used in these vehicles, the biofuels must comply with established European standards, like EN 14214 for biodiesel and EN 15376 for bioethanol, as well as EN 590 and EN 228 for diesel and gasoline blends, respectively. These standards define critical parameters such as viscosity, cetane number, water content, oxidation stability, and purity, ensuring compatibility with engine performance and emissions requirements. Consequently, no additional or specific criteria are required for these airport ground vehicles: they must simply be fuelled with biofuels that meet the conventional certification and quality benchmarks already in place for road transport

6.1.3 Groupe ADP (ADP)

Presentation

Paris-Charles de Gaulle Airport (CDG) is a French international airport located in Roissy, France. As the largest airport in France and a significant hub in Europe, CDG serves as a gateway to 304 destinations in 116 countries, making it the first airport in the European Union by passenger traffic. In 2023, CDG welcomed an average of 157,400 passengers per day, marking a significant recovery from the impacts of the COVID-19 pandemic.

CDG distinguishes itself with its high-performance operations and strategic location at the heart of Europe. The airport is a critical connecting hub, hosting three major airline hubs: Air France, FedEx Express, and La Poste. It offers the best transfer experience in Europe within a competitive international arena, facilitating seamless connections for millions of passengers annually.



The airport's infrastructure is designed for efficiency and passenger comfort, featuring state-of-the-art facilities and a seamless customer journey with smart airport technologies. These include self-service kiosks, e-border gates, and RFID bag tags¹, enhancing the travel experience for both passengers and airlines.

CDG faces several challenges, including the need to manage growing passenger traffic sustainably and reduce its carbon footprint. The airport aims to balance growth with environmental responsibility, setting ambitious targets for decarbonization and sustainability.

Decarbonization Strategy

To address its environmental impact, CDG has launched several decarbonization projects. These initiatives focus on reducing emissions through energy-efficient technologies, sustainable aviation fuels (SAF), and improved operational efficiency. The airport is also investing in renewable energy sources, such as solar and wind power, to power its operations.

Ground Fleet

CDG's ground fleet is a critical component of its operational efficiency. The airport maintains a diverse and modern fleet of ground support vehicles, including pushback tugs, catering trucks, and baggage handlers. These vehicles are designed to minimize emissions and operate with high efficiency, contributing to CDG's overall sustainability goals.

Paris-Charles de Gaulle Airport stands as a beacon of innovation and sustainability in the aviation industry. With its strategic location, cutting-edge technology, and commitment to decarbonization, CDG is well-positioned to meet the challenges of the future while continuing to serve as a vital link between Europe and the rest of the world.

6.1.4 Milano Malpensa Airport (MXP)

Presentation

Malpensa Airport, located approximately 50 km northwest of Milan within the Ticino Valley Regional Park, is the largest international airport in Northern Italy and the primary gateway for long-haul and intercontinental traffic serving the Milan metropolitan area. The airport covers approximately 1,220 hectares across seven municipalities in the Province of Varese and has an ICAO reference code of 4F, enabling it to accommodate all aircraft types currently in operation without restrictions. Unlike its former role as Alitalia's hub, Malpensa has evolved into a major international airport characterized by an extensive network of European and intercontinental destinations, a significant presence of low-cost carriers, substantial cargo activity, and predominantly origin-destination traffic. Its infrastructure includes two parallel runways, each 3,920 meters long, an extensive taxiway network of approximately 20 km, two passenger terminals, and the large Cargo City logistics area. Terminal 1, with a total area of around 360,000 m², serves most scheduled and charter traffic, while Terminal 2 is primarily dedicated to low-cost

¹ RFID bag tags are smart luggage labels embedded with tiny microchips and antennas that transmit data via radio waves



operations. The airport also benefits from direct rail connections to Milan and other regional destinations, making it a key transportation and logistics hub for Northern Italy.

Decarbonization Strategy

Sustainability is a key focus for Malpensa Airport, which has implemented the Airport Carbon Accreditation program to reduce air emissions. The airport has achieved Level 4+ Transition certification, demonstrating a strong commitment to decarbonization through offsetting activities. Efforts include calculating the airport's carbon footprint, promoting the use of Sustainable Aviation Fuel (SAF), and reducing emissions through approved offset removals.

Ground Fleet

The ground vehicle fleet at Malpensa Airport comprises a variety of vehicles, including cars, vans, and special vehicles such as pushback trucks, de-icers, and aircraft refueling tanks. The fleet is predominantly diesel-powered, with some electric vehicles used for shuttle services and passenger transport. SEA, the airport manager, owns and manages many of these vehicles, ensuring they meet sustainability and safety criteria.

Safety regulations at Malpensa Airport are outlined in the "Airport Regulations," which include specific provisions for fuel storage and distribution. The "AIRPORT SAFETY AND COMPLIANCE MONITORING MANAGEMENT" Directorate, governed by EU Regulation No. 139/2014, is responsible for implementing and managing airport safety. Quality and performance criteria for fuel use are not legally mandated but are governed by the principle that fuel must be reliable and ensure continuity of service.

In summary, Malpensa Airport stands as a vital link for Milan, balancing passenger service with a commitment to sustainability and safety. Its evolving role as a city airport, coupled with its proactive measures in decarbonization and fleet management, underscores its dedication to meeting the needs of the modern aviation landscape.

6.1.5 Conclusion of the workshop

During this WP8 workshop, representatives from the four airports presented their ground vehicle fleet configurations and fuel strategies. The collaborative session revealed a consistent technological approach across different airport environments. Notably, no specific biofuel quality requirements were established as a mandatory standard. Instead, the discussion highlighted a universal compatibility of ground vehicles with classical biodiesel solutions. Most of these vehicles use common diesel. Therefore, a biodiesel is perfectly fitting the vehicles. Common norms shall be followed, such as EN 14214.

For Compressed Natural Gas such as Crigen's project (see paragraph CRIGEN – Waste-to-biofuel project – Input for the scheme criteria) the EN 16723-2 must be selected.



6.2 CRIGEN – Waste-to-biofuel project – Input for the scheme criteria

CRIGEN is ENGIE's R&D center dedicated to emerging energies and sustainable solutions. It explores and develops innovative technologies in the fields of renewable gases (like hydrogen and biomethane), energy efficiency, and smart energy systems.

Biomethane is a renewable gaseous fuel obtained from biomass and organic waste through biological or thermochemical processes. It is essentially purified biogas with a methane content comparable to fossil natural gas, making it fully compatible with existing gas infrastructure.

It is a highly versatile energy carrier with applications across multiple sectors.

Energy and Heat Production

Biomethane can be used in:

- Combined heat and power (CHP) systems
- Gas turbines and engines
- Industrial boilers

It enables decentralized and efficient energy generation.

Injection into Natural Gas Grids

Due to its similarity to natural gas, biomethane can be directly injected into existing gas networks and used for:

- Residential heating
- Cooking
- Industrial processes

Transport Fuel

Biomethane is widely used as a renewable vehicle fuel:

- Bio-CNG (compressed biomethane)
- Bio-LNG (liquefied biomethane)

It is particularly suitable for:

- Buses and trucks
- Waste collection vehicles
- Fleet transport systems

This significantly reduces greenhouse gas emissions compared to diesel.

Industrial and Chemical Uses

Biomethane serves as a feedstock for:

- Hydrogen production
- Methanol synthesis



- Synthetic fuels and chemicals

It also plays a role in power-to-gas and circular economy systems.

As global energy systems transition toward sustainability, biomethane is increasingly recognized as a key solution for decarbonizing heating, electricity, and transport sectors. Its versatility, storability, and compatibility with current infrastructure make it a strategic renewable energy carrier.

Biomethane is produced through two main pathways: biological conversion and thermochemical conversion.

Anaerobic Digestion and Upgrading

The most widely used method (accounting for about 90% of production) is anaerobic digestion, followed by gas upgrading.

- Organic materials such as agricultural waste, manure, sewage sludge, and food waste are decomposed by microorganisms in the absence of oxygen.
- This process produces biogas, typically containing 50–75% methane and significant amounts of CO₂ and impurities.

To obtain biomethane, biogas must be purified through upgrading technologies, including:

- Water scrubbing – dissolves CO₂ and hydrogen sulfide
- Pressure swing adsorption (PSA) – uses adsorbents to separate gases
- Membrane separation – filters gases through semi-permeable membranes
- Chemical (amine) scrubbing – chemically removes CO₂

These processes increase methane concentration to over 97%, meeting natural gas standards.

Gasification and Methanation

A second method involves biomass gasification, where solid biomass (e.g., wood residues) is converted into syngas (CO + H₂), followed by methanation to produce methane.

Power-to-Methane

An emerging method combines hydrogen (produced via electrolysis) with CO₂ to generate methane. This pathway supports energy storage and integration of renewable electricity sources.

The obtained biomethane has the following main physical and chemical properties:

Chemical Composition

Biomethane is primarily composed of methane (CH₄), typically:

- Methane (CH₄): 94–99.9%
- Carbon dioxide (CO₂): 0.1–4%



- Trace gases: nitrogen, oxygen, hydrogen, etc.

Impurities such as hydrogen sulfide, water vapor, and ammonia are removed during upgrading to meet quality standards.

Physical Properties

Biomethane has properties very similar to natural gas:

- Lower heating value (LHV): ~36 MJ/m³
- Colorless and odorless (odorants added for safety)
- Compressible and liquefiable (Bio-CNG / Bio-LNG)
- High energy density in compressed/liquefied form

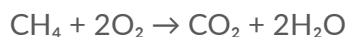
Combustion and Fuel Characteristics

- High octane number, making it suitable for engines
- Clean combustion with lower emissions compared to fossil fuels
- High thermal efficiency in energy systems

Chemical Behavior

Chemically, biomethane behaves like methane:

- Combustion reaction:



- Can be converted into other fuels (methanol, hydrogen, synthetic fuels) through catalytic or biological processes.

CRIGEN has developed a project involving the conversion of organic (or bio) municipal waste (such as food waste, green waste, and sewage sludge) into Bio-CNG through a biological process called anaerobic digestion. The biomethane is finally compressed to produce Bio-CNG, which can be used as a clean fuel, especially in public transport and waste collection vehicles.

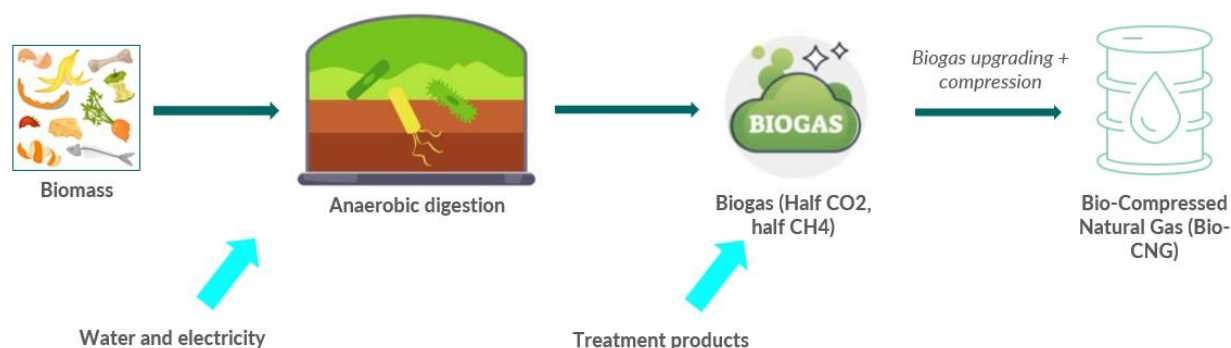


Figure 10 : CRIGEN waste-to-biofuel production pathway (source : Crigen, 2024)

The Waste-to-Biofuel project developed by CRIGEN is particularly well-suited for integration into airport infrastructures, especially within the scope of the OLGA project. Airports are often located near densely populated urban areas or metropolitan regions, which ensures a steady and substantial supply of municipal solid waste. This proximity makes it possible to tap into a large, locally available feedstock for biofuel production. By converting this waste into sustainable fuels, the project supports both the circular economy and the decarbonization of airport operations. Implementing such a solution at airports not only reduces greenhouse gas emissions and waste volumes but also contributes to local energy autonomy. This aligns perfectly with OLGA's goals to develop innovative, low-carbon solutions and to transform airports into sustainable and resilient infrastructures.

A certification scheme tailored to the CRIGEN Waste-to-Biofuel project is essential to ensure its successful integration within sustainable airport operations. This scheme must:

- › verify the sustainability of the biofuel by closely monitoring the nature and origin of the waste used, ensuring that it comes from approved, non-food, and environmentally responsible sources.
- › should also account for the greenhouse gas emissions avoided throughout the entire process (from waste collection to fuel production) demonstrating a significant climate benefit. The threshold will have to be determined.
- › In addition, the certification must guarantee the quality and performance of the produced biofuel, ensuring it meets the technical standards required for use in airport ground vehicles.

By addressing these key criteria, the certification framework will not only validate the environmental integrity of the project but also facilitate its operational deployment within the OLGA initiative.

6.3 Waste-to-Biofuel Origin Certification scheme – Criteria

As the first objective of OLGA project is to reduce the environmental impact of airports the first criterion of a waste-to-biofuel certification scheme is on sustainability.



Then the quality criteria shall be assessed for technical use. From the workshop conclusion, the common standards apply.

6.3.1 Environmental criteria

The **Renewable Energy Directive (RED)** is the European Union's legal framework promoting the use of energy from renewable sources. It sets binding targets and sustainability criteria for biofuels, bioliquids, and biomass fuels. Two key versions impact waste-to-biofuel producers:

- › RED II (Directive (EU) 2018/2001) was published in 2018[1].
- › RED III (amended RED II) – adopted in 2023 to align with the European Green Deal and Fit for 55 packages [2]

The objectives of RED are multiple:

- › Achieve at least 32% renewable energy in the EU's gross final energy consumption by 2030. Promote advanced biofuels made from waste and residues (Annex IX, Part A).
- › Ensure sustainability and greenhouse gas (GHG) savings for all biofuels used in transport.

RED III brought many updates such as

- › Increasing the 2030 renewable energy target to 42.5%, with a target of 45% (non-binding).
- › Setting sub-targets for transport: 14.5% GHG intensity reduction in transport fuels by 2030, or 29% share of renewable energy in transport by 2030. Strengthen the role of advanced biofuels and RFNBOs (Renewable Fuels of Non-Biological Origin). Enhance traceability and verification systems

If an entity is producing biofuels from waste or residues, RED II and RED III provide both requirements for biofuel production from waste.

Sustainability

To meet the sustainability criteria under the Renewable Energy Directive (RED II and RED III), waste-to-biofuel producers must demonstrate both the biogenic nature of the waste and its legal status as a waste under the EU Waste Framework Directive (Directive 2008/98/EC) [3]. This means the feedstock must be of biological origin (e.g. agricultural residues, food waste, used cooking oil) and not fossil based. In addition, it must qualify as a "waste" – that is, a substance or object the holder discards or intends to discard, as defined by the Waste Framework Directive. Proper classification is essential, as only genuine waste streams can benefit from the advanced biofuel provisions in Annex IX. Producers must ensure full traceability and documentation to prove that the material was not a co-product or primary product, but a true waste, collected and processed in compliance with EU waste management principles.



Figure 11 : Waste hierarchy according to WFD

A certification scheme for biofuel from waste for airports ground vehicles shall include the same criterion of sustainability. This will bring consistency between European Airports and the European Regulations.

GHG emission savings

Under the Renewable Energy Directive (RED II and RED III), biofuels used in transport must demonstrate significant greenhouse gas (GHG) emissions savings compared to fossil fuels. Specifically, to be considered sustainable, a transport biofuel must achieve at least 65% GHG reduction relative to the fossil fuel comparator (94 g CO₂eq/MJ), if the production installation started operating after October 2021. RED III raises this threshold to 70% for advanced biofuels listed in Annex IX Part A. The GHG savings must be calculated using a life-cycle assessment (LCA) approach, which includes emissions from cultivation or collection, processing, transport, and distribution. Producers may use default values provided in the Directive or apply actual values if verified by a recognized certification scheme. Meeting this GHG criterion is essential for the biofuel to count towards renewable energy targets and to be eligible for public support.



The equation to calculate the GHG emission savings of the biofuels used for airport ground vehicles is the following one:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr}$$

With E = total emissions from the use of the fuel;

e_{ec} = emissions from the extraction or cultivation of raw materials;

e_l = annualised emissions from carbon stock changes caused by land-use change;

e_p = emissions from processing;

e_{td} = emissions from transport and distribution;

e_u = emissions from the fuel in use;

e_{sca} = emission savings from soil carbon accumulation via improved agricultural management;

e_{ccs} = emission savings from CO₂ capture and geological storage; and

e_{ccr} = emission savings from CO₂ capture and replacement.

6.3.2 Quality criteria

In airports, as explained during the workshop, most ground vehicles operate using alternative or low-carbon fuels such as biodiesel, CNG, LNG, or drop-in fuels. While these fuels contribute to reducing greenhouse gas emissions and aligning with sustainability targets, they must also comply with strict fuel quality standards to ensure safety, compatibility, performance, and engine durability—especially in demanding operational environments like airports. Airport authorities and fuel suppliers must ensure that all fuels used in ground vehicles meet the relevant ISO and EN standards for quality and specification.

<i>Type of fuel</i>	<i>Related standard</i>
Bio-CNG	ISO 15403-1, EN 16723-2
LNG / Bio-LNG	EN ISO 16924, EN 16726, EN 16723-1
Biodiesel	EN 14214 / ISO 14214-1
Drop-in fuels	EN 15940

Table 1 : Fuels and their standards

6.3.3 Mass Balance, traceability, management system requirements

An effective certification scheme for waste-to-biofuel also includes robust mass balance, traceability, and management system requirements to ensure that the biofuels used are truly sustainable, legally compliant, and eligible for GHG savings or renewable energy targets. Even if



the airport is not the final fuel producer, its role as a distributor, user, or intermediary may place it within the usual compliance chain — especially if the fuels are accounted for in national reporting or emissions reduction plans.

Mass balance

A mass balance system is a controlled chain of custody method used to track sustainable biofuels and their attributes (e.g. GHG savings, feedstock origin) through complex supply chains — from production to end-use.

- › A system must be in place to ensure the quantity of sustainable fuel entering and leaving a site is accounted for, including Volume tracking, Energy content, and Sustainability characteristics
- › Mixing with non-sustainable fuels is allowed only if traceable and accounted for within the same system.
- › No double counting: each unit of fuel and its sustainability claim (e.g. “advanced biofuel”) must be allocated only once.
- › Auditable documentation must be kept at each step in the chain, including at the airport level if it stores, blends, or dispenses fuel.

Traceability

The usual certification scheme for biofuels requires full traceability of:

- › The feedstock type (e.g. waste oil, lignocellulosic biomass)
- › The origin and collection point (e.g. EU waste stream, Annex IX list) Any processing or transformation stages
- › The GHG emissions value attached to each fuel batch This information must flow across the chain via sustainability certificates or batch declarations, issued under a recognized voluntary certification scheme (e.g. ISCC, RSB).

At the airport level, this means:

- › Keeping records of all fuel batches received and used
- › Verifying that all deliveries come with valid sustainability documentation
- › Ensuring that there is no loss or misallocation of sustainability claims (e.g. “advanced biofuel” status)

As airports are the final user of biofuel, they are not to be certified. They must make sure the fuel suppliers have the accurate approved certification.

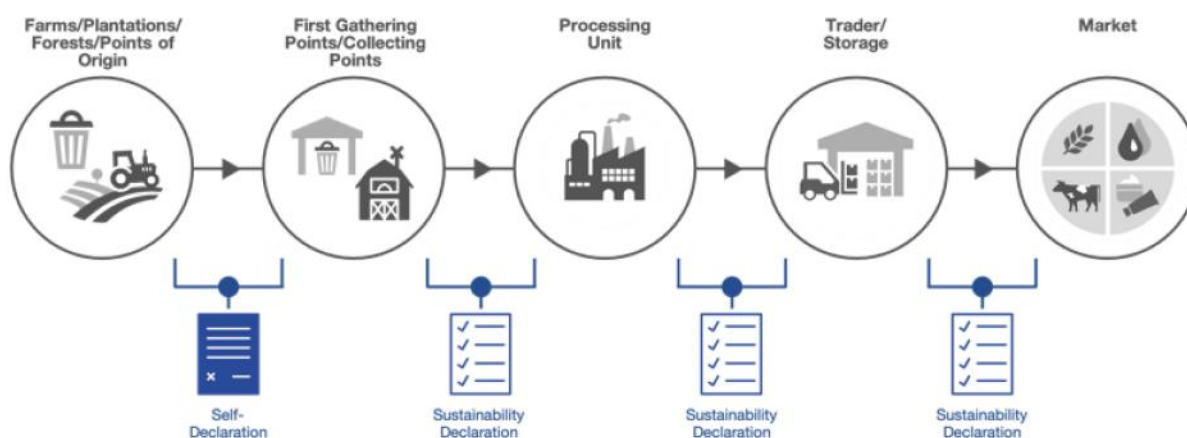


Figure 12 : Traceability all along the supply chain (source : ISCC System documents, ISCC EU 203 V4.0)

Applies under the Renewable Energy Directive (EU) 2018/2001 (RED II)

Unique Number of the PoS:

Date of issuance of the PoS:

Supplier

Name:

Address:

Certification System: **ISCC EU**

Certificate Number:

Address of dispatch/shipping point of the sustainable material:

☐ Same as address of supplier

Address of receipt/receiving point of the sustainable material:

☐ Same as address of recipient

Date of dispatch of the sustainable material:

Producer of biofuel/bioethanol/biomethane:

☐ Date of installation:

User of biofuel/biomethane/bioethanol:

☐ Date of installation:

1. General information

Type of Product:

Type of Raw Material:

Country of Origin (of the raw material):

Quantity:

Energy content (MJ):

EU RED Compliant material? ☒ Yes ☐ No

ISCC Compliant material (voluntary)? ☐ Yes ☒ No

Check of custody options (optional)

2. Scope of certification of raw material

The raw material complies with the relevant sustainability criteria according to Art. 29 (2) - (1) RED II? ☐ Yes ☒ No

The agricultural biomass was cultivated as intermediate crop (if applicable)? ☐ Yes ☒ No

The agricultural biomass additionally fulfills the assurance for low ILUC risk feedstocks (if applicable)? ☐ Yes ☒ No

The raw material meets the definition of waste or residue according to the RED II? ☐ Yes ☒ No

If applicable, please specify NUTS 2 region:

3. Greenhouse Gas (GHG) emission information

Total default value according to RED II applied? ☐ Yes ☒ No

E = Total GHG emissions from supply and use of the fuel (gCO₂e/MJ)

E₁ = E₂ = E₃ = E₄ = E₅ = E₆ = E₇ = E₈ = E₉ = E₁₀ = E₁₁ = E₁₂ = E₁₃ = E₁₄ = E₁₅ = E₁₆ = E₁₇ = E₁₈ = E₁₉ = E₂₀ = E₂₁ = E₂₂ = E₂₃ = E₂₄ = E₂₅ = E₂₆ = E₂₇ = E₂₈ = E₂₉ = E₃₀ = E₃₁ = E₃₂ = E₃₃ = E₃₄ = E₃₅ = E₃₆ = E₃₇ = E₃₈ = E₃₉ = E₄₀ = E₄₁ = E₄₂ = E₄₃ = E₄₄ = E₄₅ = E₄₆ = E₄₇ = E₄₈ = E₄₉ = E₅₀ = E₅₁ = E₅₂ = E₅₃ = E₅₄ = E₅₅ = E₅₆ = E₅₇ = E₅₈ = E₅₉ = E₆₀ = E₆₁ = E₆₂ = E₆₃ = E₆₄ = E₆₅ = E₆₆ = E₆₇ = E₆₈ = E₆₉ = E₇₀ = E₇₁ = E₇₂ = E₇₃ = E₇₄ = E₇₅ = E₇₆ = E₇₇ = E₇₈ = E₇₉ = E₈₀ = E₈₁ = E₈₂ = E₈₃ = E₈₄ = E₈₅ = E₈₆ = E₈₇ = E₈₈ = E₈₉ = E₉₀ = E₉₁ = E₉₂ = E₉₃ = E₉₄ = E₉₅ = E₉₆ = E₉₇ = E₉₈ = E₉₉ = E₁₀₀ = E₁₀₁ = E₁₀₂ = E₁₀₃ = E₁₀₄ = E₁₀₅ = E₁₀₆ = E₁₀₇ = E₁₀₈ = E₁₀₉ = E₁₁₀ = E₁₁₁ = E₁₁₂ = E₁₁₃ = E₁₁₄ = E₁₁₅ = E₁₁₆ = E₁₁₇ = E₁₁₈ = E₁₁₉ = E₁₂₀ = E₁₂₁ = E₁₂₂ = E₁₂₃ = E₁₂₄ = E₁₂₅ = E₁₂₆ = E₁₂₇ = E₁₂₈ = E₁₂₉ = E₁₃₀ = E₁₃₁ = E₁₃₂ = E₁₃₃ = E₁₃₄ = E₁₃₅ = E₁₃₆ = E₁₃₇ = E₁₃₈ = E₁₃₉ = E₁₄₀ = E₁₄₁ = E₁₄₂ = E₁₄₃ = E₁₄₄ = E₁₄₅ = E₁₄₆ = E₁₄₇ = E₁₄₈ = E₁₄₉ = E₁₅₀ = E₁₅₁ = E₁₅₂ = E₁₅₃ = E₁₅₄ = E₁₅₅ = E₁₅₆ = E₁₅₇ = E₁₅₈ = E₁₅₉ = E₁₆₀ = E₁₆₁ = E₁₆₂ = E₁₆₃ = E₁₆₄ = E₁₆₅ = E₁₆₆ = E₁₆₇ = E₁₆₈ = E₁₆₉ = E₁₇₀ = E₁₇₁ = E₁₇₂ = E₁₇₃ = E₁₇₄ = E₁₇₅ = E₁₇₆ = E₁₇₇ = E₁₇₈ = E₁₇₉ = E₁₈₀ = E₁₈₁ = E₁₈₂ = E₁₈₃ = E₁₈₄ = E₁₈₅ = E₁₈₆ = E₁₈₇ = E₁₈₈ = E₁₈₉ = E₁₉₀ = E₁₉₁ = E₁₉₂ = E₁₉₃ = E₁₉₄ = E₁₉₅ = E₁₉₆ = E₁₉₇ = E₁₉₈ = E₁₉₉ = E₂₀₀ = E₂₀₁ = E₂₀₂ = E₂₀₃ = E₂₀₄ = E₂₀₅ = E₂₀₆ = E₂₀₇ = E₂₀₈ = E₂₀₉ = E₂₁₀ = E₂₁₁ = E₂₁₂ = E₂₁₃ = E₂₁₄ = E₂₁₅ = E₂₁₆ = E₂₁₇ = E₂₁₈ = E₂₁₉ = E₂₂₀ = E₂₂₁ = E₂₂₂ = E₂₂₃ = E₂₂₄ = E₂₂₅ = E₂₂₆ = E₂₂₇ = E₂₂₈ = E₂₂₉ = E₂₃₀ = E₂₃₁ = E₂₃₂ = E₂₃₃ = E₂₃₄ = E₂₃₅ = E₂₃₆ = E₂₃₇ = E₂₃₈ = E₂₃₉ = E₂₄₀ = E₂₄₁ = E₂₄₂ = E₂₄₃ = E₂₄₄ = E₂₄₅ = E₂₄₆ = E₂₄₇ = E₂₄₈ = E₂₄₉ = E₂₅₀ = E₂₅₁ = E₂₅₂ = E₂₅₃ = E₂₅₄ = E₂₅₅ = E₂₅₆ = E₂₅₇ = E₂₅₈ = E₂₅₉ = E₂₆₀ = E₂₆₁ = E₂₆₂ = E₂₆₃ = E₂₆₄ = E₂₆₅ = E₂₆₆ = E₂₆₇ = E₂₆₈ = E₂₆₉ = E₂₇₀ = E₂₇₁ = E₂₇₂ = E₂₇₃ = E₂₇₄ = E₂₇₅ = E₂₇₆ = E₂₇₇ = E₂₇₈ = E₂₇₉ = E₂₈₀ = E₂₈₁ = E₂₈₂ = E₂₈₃ = E₂₈₄ = E₂₈₅ = E₂₈₆ = E₂₈₇ = E₂₈₈ = E₂₈₉ = E₂₉₀ = E₂₉₁ = E₂₉₂ = E₂₉₃ = E₂₉₄ = E₂₉₅ = E₂₉₆ = E₂₉₇ = E₂₉₈ = E₂₉₉ = E₃₀₀ = E₃₀₁ = E₃₀₂ = E₃₀₃ = E₃₀₄ = E₃₀₅ = E₃₀₆ = E₃₀₇ = E₃₀₈ = E₃₀₉ = E₃₁₀ = E₃₁₁ = E₃₁₂ = E₃₁₃ = E₃₁₄ = E₃₁₅ = E₃₁₆ = E₃₁₇ = E₃₁₈ = E₃₁₉ = E₃₂₀ = E₃₂₁ = E₃₂₂ = E₃₂₃ = E₃₂₄ = E₃₂₅ = E₃₂₆ = E₃₂₇ = E₃₂₈ = E₃₂₉ = E₃₃₀ = E₃₃₁ = E₃₃₂ = E₃₃₃ = E₃₃₄ = E₃₃₅ = E₃₃₆ = E₃₃₇ = E₃₃₈ = E₃₃₉ = E₃₄₀ = E₃₄₁ = E₃₄₂ = E₃₄₃ = E₃₄₄ = E₃₄₅ = E₃₄₆ = E₃₄₇ = E₃₄₈ = E₃₄₉ = E₃₅₀ = E₃₅₁ = E₃₅₂ = E₃₅₃ = E₃₅₄ = E₃₅₅ = E₃₅₆ = E₃₅₇ = E₃₅₈ = E₃₅₉ = E₃₆₀ = E₃₆₁ = E₃₆₂ = E₃₆₃ = E₃₆₄ = E₃₆₅ = E₃₆₆ = E₃₆₇ = E₃₆₈ = E₃₆₉ = E₃₇₀ = E₃₇₁ = E₃₇₂ = E₃₇₃ = E₃₇₄ = E₃₇₅ = E₃₇₆ = E₃₇₇ = E₃₇₈ = E₃₇₉ = E₃₈₀ = E₃₈₁ = E₃₈₂ = E₃₈₃ = E₃₈₄ = E₃₈₅ = E₃₈₆ = E₃₈₇ = E₃₈₈ = E₃₈₉ = E₃₉₀ = E₃₉₁ = E₃₉₂ = E₃₉₃ = E₃₉₄ = E₃₉₅ = E₃₉₆ = E₃₉₇ = E₃₉₈ = E₃₉₉ = E₄₀₀ = E₄₀₁ = E₄₀₂ = E₄₀₃ = E₄₀₄ = E₄₀₅ = E₄₀₆ = E₄₀₇ = E₄₀₈ = E₄₀₉ = E₄₁₀ = E₄₁₁ = E₄₁₂ = E₄₁₃ = E₄₁₄ = E₄₁₅ = E₄₁₆ = E₄₁₇ = E₄₁₈ = E₄₁₉ = E₄₂₀ = E₄₂₁ = E₄₂₂ = E₄₂₃ = E₄₂₄ = E₄₂₅ = E₄₂₆ = E₄₂₇ = E₄₂₈ = E₄₂₉ = E₄₃₀ = E₄₃₁ = E₄₃₂ = E₄₃₃ = E₄₃₄ = E₄₃₅ = E₄₃₆ = E₄₃₇ = E₄₃₈ = E₄₃₉ = E₄₄₀ = E₄₄₁ = E₄₄₂ = E₄₄₃ = E₄₄₄ = E₄₄₅ = E₄₄₆ = E₄₄₇ = E₄₄₈ = E₄₄₉ = E₄₅₀ = E₄₅₁ = E₄₅₂ = E₄₅₃ = E₄₅₄ = E₄₅₅ = E₄₅₆ = E₄₅₇ = E₄₅₈ = E₄₅₉ = E₄₆₀ = E₄₆₁ = E₄₆₂ = E₄₆₃ = E₄₆₄ = E₄₆₅ = E₄₆₆ = E₄₆₇ = E₄₆₈ = E₄₆₉ = E₄₇₀ = E₄₇₁ = E₄₇₂ = E₄₇₃ = E₄₇₄ = E₄₇₅ = E₄₇₆ = E₄₇₇ = E₄₇₈ = E₄₇₉ = E₄₈₀ = E₄₈₁ = E₄₈₂ = E₄₈₃ = E₄₈₄ = E₄₈₅ = E₄₈₆ = E₄₈₇ = E₄₈₈ = E₄₈₉ = E₄₉₀ = E₄₉₁ = E₄₉₂ = E₄₉₃ = E₄₉₄ = E₄₉₅ = E₄₉₆ = E₄₉₇ = E₄₉₈ = E₄₉₉ = E₅₀₀ = E₅₀₁ = E₅₀₂ = E₅₀₃ = E₅₀₄ = E₅₀₅ = E₅₀₆ = E₅₀₇ = E₅₀₈ = E₅₀₉ = E₅₁₀ = E₅₁₁ = E₅₁₂ = E₅₁₃ = E₅₁₄ = E₅₁₅ = E₅₁₆ = E₅₁₇ = E₅₁₈ = E₅₁₉ = E₅₂₀ = E₅₂₁ = E₅₂₂ = E₅₂₃ = E₅₂₄ = E₅₂₅ = E₅₂₆ = E₅₂₇ = E₅₂₈ = E₅₂₉ = E₅₃₀ = E₅₃₁ = E₅₃₂ = E₅₃₃ = E₅₃₄ = E₅₃₅ = E₅₃₆ = E₅₃₇ = E₅₃₈ = E₅₃₉ = E₅₄₀ = E₅₄₁ = E₅₄₂ = E₅₄₃ = E₅₄₄ = E₅₄₅ = E₅₄₆ = E₅₄₇ = E₅₄₈ = E₅₄₉ = E₅₅₀ = E₅₅₁ = E₅₅₂ = E₅₅₃ = E₅₅₄ = E₅₅₅ = E₅₅₆ = E₅₅₇ = E₅₅₈ = E₅₅₉ = E₅₆₀ = E₅₆₁ = E₅₆₂ = E₅₆₃ = E₅₆₄ = E₅₆₅ = E₅₆₆ = E₅₆₇ = E₅₆₈ = E₅₆₉ = E₅₇₀ = E₅₇₁ = E₅₇₂ = E₅₇₃ = E₅₇₄ = E₅₇₅ = E₅₇₆ = E₅₇₇ = E₅₇₈ = E₅₇₉ = E₅₈₀ = E₅₈₁ = E₅₈₂ = E₅₈₃ = E₅₈₄ = E₅₈₅ = E₅₈₆ = E₅₈₇ = E₅₈₈ = E₅₈₉ = E₅₉₀ = E₅₉₁ = E₅₉₂ = E₅₉₃ = E₅₉₄ = E₅₉₅ = E₅₉₆ = E₅₉₇ = E₅₉₈ = E₅₉₉ = E₆₀₀ = E₆₀₁ = E₆₀₂ = E₆₀₃ = E₆₀₄ = E₆₀₅ = E₆₀₆ = E₆₀₇ = E₆₀₈ = E₆₀₉ = E₆₁₀ = E₆₁₁ = E₆₁₂ = E₆₁₃ = E₆₁₄ = E₆₁₅ = E₆₁₆ = E₆₁₇ = E₆₁₈ = E₆₁₉ = E₆₂₀ = E₆₂₁ = E₆₂₂ = E₆₂₃ = E₆₂₄ = E₆₂₅ = E₆₂₆ = E₆₂₇ = E₆₂₈ = E₆₂₉ = E₆₃₀ = E₆₃₁ = E₆₃₂ = E₆₃₃ = E₆₃₄ = E₆₃₅ = E₆₃₆ = E₆₃₇ = E₆₃₈ = E₆₃₉ = E₆₄₀ = E₆₄₁ = E₆₄₂ = E₆₄₃ = E₆₄₄ = E₆₄₅ = E₆₄₆ = E₆₄₇ = E₆₄₈ = E₆₄₉ = E₆₅₀ = E₆₅₁ = E₆₅₂ = E₆₅₃ = E₆₅₄ = E₆₅₅ = E₆₅₆ = E₆₅₇ = E₆₅₈ = E₆₅₉ = E₆₆₀ = E₆₆₁ = E₆₆₂ = E₆₆₃ = E₆₆₄ = E₆₆₅ = E₆₆₆ = E₆₆₇ = E₆₆₈ = E₆₆₉



- › Clear organizational procedures for fuel sourcing, reception, handling, and documentation
- › Personnel training on sustainability and documentation requirements
- › Data management tools (manual or digital) to track fuel batches and attributes
- › Internal audits and continuous improvement
- › External verification by an EU-recognized certification body
- › While airports may not produce fuels themselves, they are often required to support audits or supply records if they store or distribute certified biofuels.

6.3.4 Compatibility with other schemes

To ensure the sustainability and legal compliance of a waste-derived biofuel used in an airport setting, two complementary layers of certification are required:

First, the biofuel must be certified under the Renewable Energy Directive (RED II / RED III) by a recognized voluntary certification scheme such as ISCC EU or REDCert EU. This certification verifies that:

- › The feedstock qualifies as waste or residue, in line with the EU Waste Framework Directive;
- › The biofuel meets RED sustainability criteria, including greenhouse gas (GHG) savings, traceability, and mass balance system integrity;
- › The production and supply chain are fully auditable and transparent.

Second, the biofuel must comply with the relevant technical fuel quality standards (ISO / EN) applicable to its type and end use. For instance:

- › EN 14214 for biodiesel (FAME),
- › EN 15940 for drop-in paraffinic fuels like HVO,
- › EN 16723-2 for bio-CNG (such as Crigen's project),
- › EN ISO 16924 for bio-LNG,
- › Or EN 17124 / ISO 14687 for hydrogen.

These standards ensure the fuel is safe, engine-compatible, and operationally reliable, which is critical in the high-performance, safety-sensitive environment of airports. Together, RED sustainability certification and ISO/EN quality compliance form the foundation for the legitimate and effective deployment of biofuels in airport ground operations – enabling decarbonization efforts without compromising performance or regulatory alignment.

6.4 Waste-to-Biofuel Origin Certification scheme – Governance

To ensure the integrity, transparency, and credibility of a certification scheme dedicated to promoting the use of waste-based biofuels in airport ground vehicles, a robust and clearly defined governance structure is essential. Below is a proposed framework outlining the roles and responsibilities of the key actors involved.

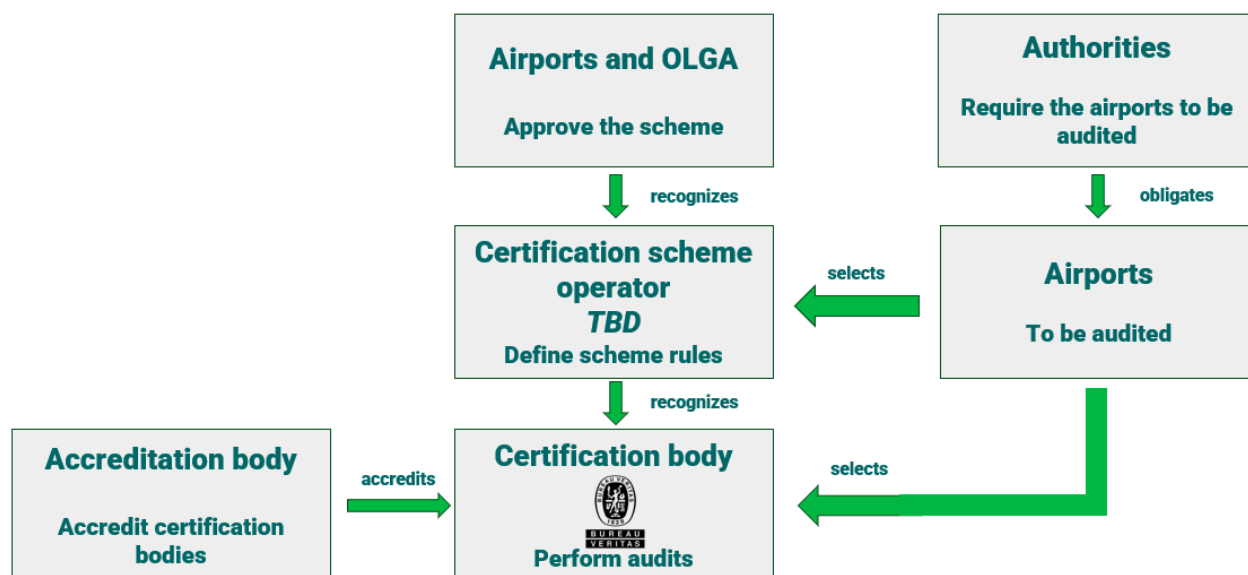


Figure 14 : Possible governance for the waste-to-biofuel certification scheme

The Certification scheme operator

The Certification scheme operator is the entity responsible for developing, maintaining, and overseeing the certification scheme. This includes defining eligibility criteria, sustainability requirements, traceability protocols, and compliance frameworks for the production and use of biofuels derived from waste. Its responsibilities are:

- Design the certification standard and criteria.
- Develop audit procedures and documentation requirements.
- Monitor and update the scheme to reflect regulatory, technological, and market evolutions.
- Provide training and guidance to Certification Bodies.

For the Waste-to-biofuel certification scheme: A public-private consortium, a standards development organization (such as ISCC or Bureau Veritas), or a dedicated non-profit body created under the OLGA project umbrella.

The Scheme Approver

The Scheme Approver is the authority or stakeholder body that validates and recognizes the certification scheme as credible and aligned with airport environmental policies or public sustainability goals. Responsibilities: review and approve the scheme developed by the Scheme Owner. Ensure alignment with EU or national climate and waste policies. Act as a supervisory body to assess the overall performance and relevance of the scheme.



In the case of the Cluj case study, the Scheme Approver is represented by local authorities, although being a pilot in a project, it is not expected to apply the certification rules. However, it is important for several airport stakeholders to understand the process of *who is doing what*.

Thus, the responsibilities to review and approve the scheme developed by the Scheme Owner lies with Cluj Airport.

To ensure alignment with EU or national climate and waste policies: interaction with the Romanian CAA and the Ministry of Environment/Local Environmental Agency.

Act as a supervisory body to assess the overall performance and relevance of the scheme: Cluj County Council, as the administrator of the region.

Certification Bodies (CBs)

Certification Bodies are third-party organizations accredited to audit and certify entities (e.g., fuel producers, suppliers, airport service providers) against the scheme's requirements.

CB's responsibilities:

- › Conduct independent audits and inspections.
- › Assess compliance with the scheme's technical and sustainability criteria.
- › Issue certificates of conformity for compliant actors.
- › Report certification data to the Scheme Owner.

CB's requirements:

- › Must be accredited by a recognized Accreditation Body.
- › Operate independently and impartially.

For an airport Waste-to-biofuel certification scheme, Bureau Veritas could be a CB as it already is for other sustainability certification schemes like ISCC EU.

Accreditation Bodies

Accreditation Bodies are official organizations responsible for assessing and accrediting Certification Bodies to ensure their competence and impartiality. For instance, in France, this role is typically played by COFRAC (Comité Français d'Accréditation). They are involved in any certification scheme process as they accredit the rights for auditors to carry out audits.

Examples: COFRAC (France) DAkkS (Germany) UKAS (United Kingdom)

7 2nd lever : Sustainable Aviation Fuels (SAF) Certification for aircrafts

Another lever for decarbonizing airports is to reduce emissions from aircraft, which constitute a large part of Scope 3 emissions for airports and the majority of emissions in the aviation sector.



There are several technologies available to reduce emissions from aircraft, including electrification, hydrogen, and the use of drop-in fuels.

Electrification of aircraft is not yet mature and would require changing all engines and technology on airplanes, which is not feasible at this time. There have been a few cases of electric aircraft for short distances and small volumes, such as the Solar Impulse, but these are not yet viable on an industrial scale.

Another option is the use of hydrogen, which will be discussed in the section entitled "3rd lever : "H2 ready" airport standard".

However, one interesting lever for reducing emissions from aircraft is the use of drop-in fuels, also known as SAF (Sustainable Aviation Fuel). These fuels have the same technology as current engines, so there is no need to change the entire engine. Instead, the focus is on ensuring the production of the fuel is sustainable.

7.1 Definition of SAF

SAF is a type of aviation fuel produced from sustainable feedstocks, such as waste vegetable oils, agricultural residues, or algae. It is designed to reduce the carbon emissions associated with air travel, as it can provide up to an 80% reduction in greenhouse gas emissions compared to traditional jet fuel.

Chemically, it is similar to conventional jet fuel and can be used in existing aircraft engines and fueling infrastructure, making it a practical and scalable solution for reducing the aviation industry's carbon footprint. It is also produced using more sustainable methods, such as waste-to-fuel processes, that do not rely on fossil fuels.

SAF is a key component of the aviation industry's efforts to reduce its carbon emissions and transition to more sustainable practices. In fact, many airlines and airports around the world have already started using SAF, and the market for SAF is expected to grow significantly in the coming years.

7.2 Certification for SAF

The journey towards sustainability for the aviation industry is significantly incentivized by European regulations, particularly the **ReFuelEU Aviation** initiative. This regulation mandates that aviation stakeholders, including airlines, airports, and fuel producers contribute to the deployment of renewable products. By setting specific targets for the reduction of greenhouse gas emissions, ReFuelEU Aviation encourages the adoption of sustainable aviation fuels (SAFs) and other renewable energy sources. This regulatory framework not only drives innovation in the production and use of renewable fuels but also fosters collaboration among industry players to achieve collective sustainability goals. The implementation of such policies is crucial in accelerating the transition to a low-carbon aviation sector, aligning with broader European objectives to address climate change and promote environmental objectives. Through these regulatory incentives, the



aviation industry is poised to make substantial strides in reducing its carbon footprint and contributing to a more sustainable future.

Two different definitions of SAF exist, depending on the framework : CORSIA for the global scale, ReFuel EU Aviation for the European scale.

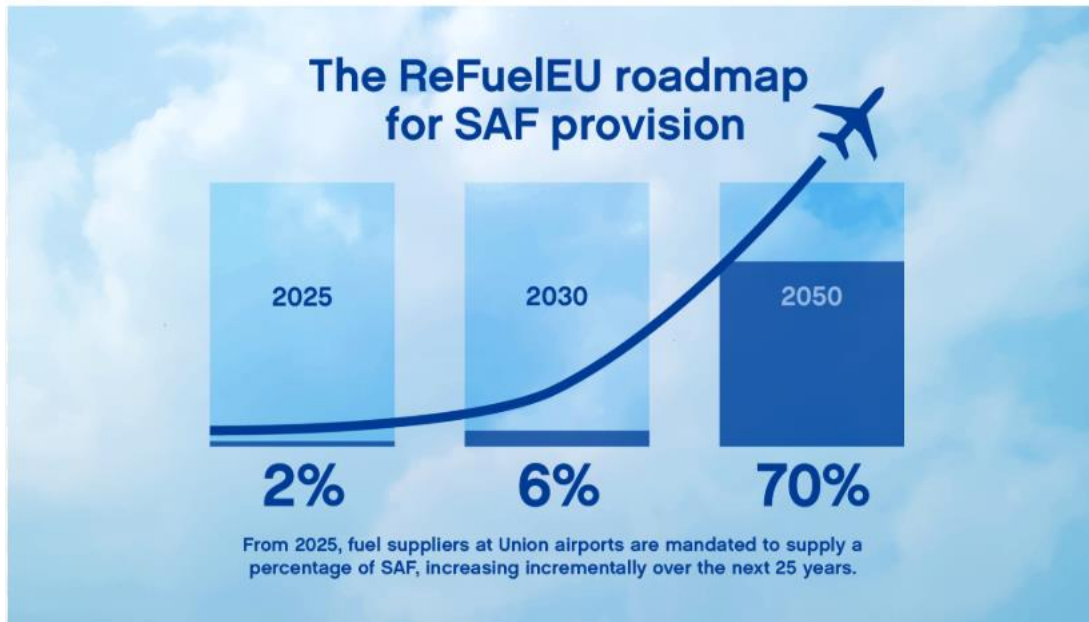


Figure 15 : ReFuelEU's target for 2050

7.3 SAF for CORSIA

The **Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)** is an initiative adopted by the International Civil Aviation Organization (ICAO) in 2016. CORSIA aims to stabilize carbon dioxide (CO₂) emissions from international aviation starting from 2020, after a period of growth.

This program is based on the principle of "carbon neutrality" and involves compensating for CO₂ emissions beyond a certain threshold. Airlines are required to offset their carbon emissions through projects that reduce emissions in other sectors, such as energy efficiency, renewable energy, and forest protection.

CORSIA is designed to be a global, inclusive, and progressive mechanism, applying to all countries and airlines, thereby contributing to the goals of the Paris Agreement on climate change.

Under CORSIA, two categories of fuels are accepted to help offset carbon emissions: **Sustainable Aviation Fuels (SAF)** and **e-Fuels**.



- **Sustainable Aviation Fuels (SAF):** These are biofuels derived from biomass, such as plant materials, animal fats, and waste products. SAFs can significantly reduce lifecycle greenhouse gas emissions compared to conventional jet fuel.
- **e-Fuels:** These are synthetic fuels produced using electricity from renewable sources through electrolysis. e-Fuels are considered a long-term solution for decarbonizing aviation, as they can be used in existing aircraft and infrastructure without modifications.

Both SAF and e-Fuels play a crucial role in helping the aviation industry meet its carbon reduction targets under CORSIA.

Today, **the landscape of sustainable aviation fuels (SAF) has seen significant development.** Numerous producers have emerged, and certification schemes such as ISCC CORSIA have been established to ensure the quality and sustainability of these fuels. This growth has been driven by increasing demand for greener alternatives to conventional jet fuel and the need to meet carbon reduction targets set by initiatives like CORSIA.

However, while the SAF sector is flourishing, **the e-fuels sector remains in a nascent stage.** Despite the potential of e-fuels to provide a long-term solution for decarbonizing aviation, the industry is still awaiting comprehensive guidelines and further development. The lack of standardized regulations and certification processes has hindered the widespread adoption of e-fuels. As a result, while SAFs are becoming more prevalent, e-fuels are yet to make a significant impact in the aviation industry. The future of e-fuels will depend on the establishment of clear guidelines and the support of stakeholders to drive their development and integration into the aviation sector.

7.4 SAF for ReFuelEU AVIATION

The definition of Sustainable Aviation Fuels (SAF) in the FuelEU Aviation regulation stems from **Directive (EU) 2018/2001**, also known as the **Renewable Energy Directive II (RED II)**. This directive sets out a comprehensive framework for the promotion of renewable energy, including detailed requirements and criteria for the certification of SAF. Unlike the CORSIA program, which has not established a mandatory scheme for the use of SAF for international flights, the RED II has set out specific provisions that are applicable at the Union level. This regulatory foundation has facilitated the development and adoption of SAF in the aviation sector, contributing to the Union's climate and environmental objectives.

In ReFuelEU AVIATION, to be considered as SAF, the fuel needs to be certified by one of the approved certification schemes compliant with the RED regulation. The list of these schemes can be found below:

https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en

For OLGA project, 2 pathways are possible to certify the SAF for EU market:

- Bio-SAF, if the energy content of the molecule comes from biogenic inputs (e.g. gasification of biogenic waste)



- RFNBO (Renewable Fuel of Non-Biological Origin), if the SAF is made from electrolysis out of renewable electricity (solar, wind, hydro, geothermal, etc.). It is called e-SAF then.

Therefore, the sustainability of the aviation fuels depends on the RED certification of the SAF that is supplied to the aircrafts. If the SAF can be certified (either bio-SAF, or e-SAF), the consumption of this fuel is sustainable in a European Regulation point of view.

7.5 Standard for SAF in airports

To ensure the quality and safety of SAF, there are several standards and certifications in place. The most relevant standard for airports regarding SAF is ASTM. The ASTM (American Society for Testing and Materials) certification ensures that Sustainable Aviation Fuels (SAF) meet the strict technical standards necessary for ensuring flight safety. This certification is important for establishing the quality and safety of SAF, which is increasingly being used as a low-carbon alternative to traditional jet fuel. The two most relevant ones are the following:

- **ASTM D7566:** This is the standard specification for aviation turbine fuel containing synthesized hydrocarbons. It sets the requirements and circumstances necessary for the production and use of SAF, including the feedstocks and production processes.
- **ASTM D4054:** This is the standard practice for qualification and approval of new aviation turbine fuels and fuel additives. It provides a framework for the qualification and approval of new SAF products. Acceptance requires demonstrating that a fuel is credible and can be produced at a meaningful scale, but also that it has met strict quality and safety criteria.

These standards provide a framework for the production, testing, and use of SAF in the aviation industry. By adhering to these standards, airports can ensure the quality and safety of SAF and contribute to the reduction of the aviation industry's carbon footprint.



Figure 16 : ASTM logo



8 3rd lever : “H2 ready” airport standard

Hydrogen is a promising lever for decarbonizing airports due to its high energy content (PCI = 3.00 kWh/Nm³) and the absence of emissions during its combustion. It can be used for both ground vehicles and aircraft, but it presents significant risks of explosion due to its volatility and high PCI. Therefore, it is crucial to establish strict guidelines and regulations for its use to ensure safety and prevent accidents.

Hydrogen can be produced through various methods, including electrolysis, steam methane reforming, and biomass gasification. Electrolysis, which uses electricity to split water molecules into hydrogen and oxygen, is the cleanest method, but it is also the most expensive. Steam methane reforming, on the other hand, is the most common method, but it produces significant greenhouse gas emissions. Biomass gasification, which converts organic matter into hydrogen through a thermochemical process, is a promising method for producing renewable hydrogen.

8.1 Certification for H2 for aircrafts and onsite vehicles

Hydrogen has the potential to be classified under both Sustainable Aviation Fuels (SAF) and e-Fuels, depending on the method of production. However, the pathways authorized for SAF are fixed, and hydrogen is not included in these pathways. As a result, **today, hydrogen cannot be considered a CORSIA eligible fuel**. The current framework for SAF does not accommodate hydrogen, limiting its use in offsetting carbon emissions under the CORSIA program. This exclusion highlights the need for further development and guidelines to integrate hydrogen into the aviation industry's sustainability efforts.

European framework RED and ReFuel EU Aviation have also introduced objectives for hydrogen fuel in aircraft. For that, fuel producer shall comply with RED requirements as biofuel (for H₂ made from biomass origin) or e-fuel (made from electrolysis and renewable electricity).

In both cases, the fuel producer shall be certified by one of the accredited voluntary schemes by the RED such as ISCC EU, CertifHy EU RFNBO, REDCert or others. The criteria are the same as presented above :

Sustainability of the input (biomass or renewable electricity)

GHG emissions savings compared with a fossil fuel reference

Mass balance

Traceability

Management System

For airports, onsite vehicles can comply with the same requirements by buying fuel certified by these voluntary schemes in accordance with RED (and with ReFuel EU Aviation). Today, the airports' fleet of onsite vehicles are not adapted for hydrogen supply. Therefore, this lever of decarbonization would require to renew the fleet.



The airports adaption for hydrogen supply (and explosion related precautions) are addressed in other work packages of Olga project.

8.2 Standards for the airports

To ensure the quality and safety of H₂, there are several standards and certifications in place. The most relevant standards for airports regarding H₂ are ASTM mentioned in the previous paragraph and SAE International. SAE (Society of Automotive Engineers), is a professional organization that develops technical standards for various industries, including automotive and aerospace.

The most relevant ones are the following:

- **ASTM WK85474:** This is the proposed new specification for aviation hydrogen fuels. It covers the use of purchasing agencies in preparing specifications for the acquisition of hydrogen fuel intended for aviation uses and defines the minimum property requirements for aviation hydrogen for use as a fuel cell or turbine fuel.
- **SAE AIR8466:** This is a current standard for hydrogen fueling stations for airports, in both gaseous and liquid form. It establishes a baseline for hydrogen fueling protocol and process limits for both gaseous and liquid hydrogen fueling of aircraft at the airport.



Figure 17 : SAE logo

8.3 Masterplan for H₂-ready airports (from Olga D5.3 [8])

An H₂-ready airport shall demonstrate that it follows a complete, structured master-planning process specifically addressing the integration of hydrogen technologies on both landside and airside.

Based on the OLGA D5.3 deliverable [8], the process consists of seven mandatory steps:

- **Traffic Study & Hydrogen Demand Assessment**



Quantify long-term hydrogen needs, including ramp-up phases, daily volumes and peak flows per terminal.

- **Hydrogen Supply-Chain Definition**

Identify and assess suitable hydrogen supply models according to airport scale, including truck-based liquid H₂ delivery, pipeline gaseous H₂ import with on-site liquefaction, on-site electrolysis, or liquid H₂ maritime import (for coastal airports).

- **Pre-Design of liquid H₂ Facilities**

Establish preliminary layout, sizing and land reservations for liquefaction, storage, distribution, and truck parking.

- **Regulatory & Standards Compliance Review**

Apply EASA Basic Regulation 1139/2018, EU Regulation 139/2014, SERA rules, and ICAO/industrial hazard requirements, ensuring hydrogen is integrated in aerodrome design, operations and SMS.

- **Operational & Functional Requirements Definition**

Define access, co-activity rules, RFFS (Rescue and firefighting services) capabilities, safety distances, refueling constraints, hydrant feasibility and maintenance requirements.

- **Site Evaluation**

Select appropriate areas on the platform based on safety distances, airside connectivity, accessibility, and utility connections (electricity, gaseous H₂ pipeline, water).

- **Integration into the Airport Master Plan**

Incorporate the facility footprints, utility requirements and phasing into long-term master-planning documents, reserving land and power capacity for progressive deployment

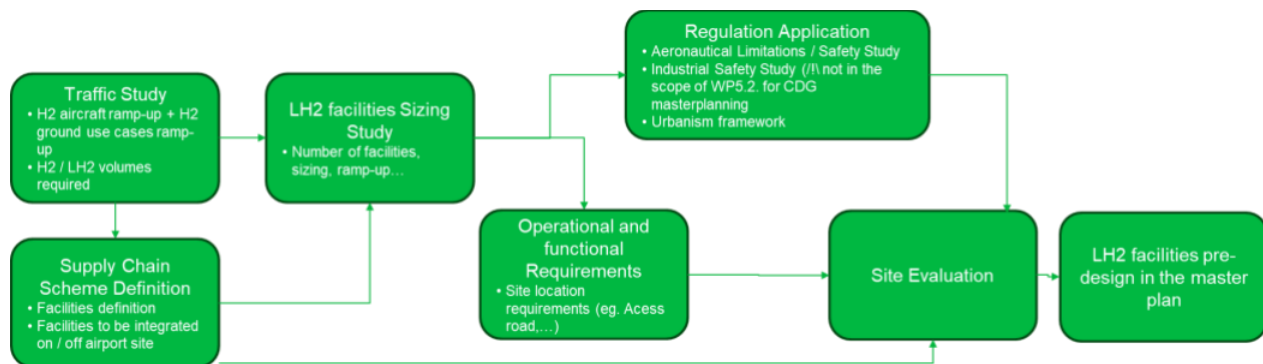


Figure 18 : Steps of H2-ready airport masterplan

8.4 Hydrogen Supply-Chain Architectures for Airports

To ensure safe, reliable and scalable supply of hydrogen, an H2-ready airport shall demonstrate the compatibility of its infrastructure with at least one of the following supply-chain architectures

H2 delivery to airport

- Liquid H2 Import by Trucks (End-to-End Truck Logistics)

The LH₂ is delivered from external liquefaction plants. This configuration is great for early phases as low CAPEX is expected. Low CAPEX, high flexibility, but increasing traffic and logistical burden.

- Gaseous H2 Import via Pipeline + On-Site Liquefaction

The gaseous H₂ is produced off-site, transported through pipeline, and liquefied at airport. As a consequence, the truck traffic is reduced, and higher volumes of hydrogen can be delivered.

- On-Site Hydrogen Production + Liquefaction

In that architecture, the hydrogen is produced on site through electrolysis using renewable power. This brings energy independence but requires very large electrical capacities.

- Liquid H2 Maritime Import for Coastal Airports

The liquid hydrogen can also be imported by ship, then trucked or piped to the airport. This case is relevant only for ports directly connected to airport supply corridors.

Distribution to Aircraft

Two main options are possible for the distribution to aircraft

- Truck-based distribution



- Liquid hydrogen hydrant pipeline system, required for large hubs including boil-off return line and cryogenic loop

Airports can select each of these supply chains, but have to ensure the traceability and chain of custody does not jeopardize the sustainable certification presented in H.1).

In case the different steps are owned by different entities, multiple certification might be required. Therefore, the cost and complexity of certification is another criteria to balance between these different architecture for an H2-ready airport.

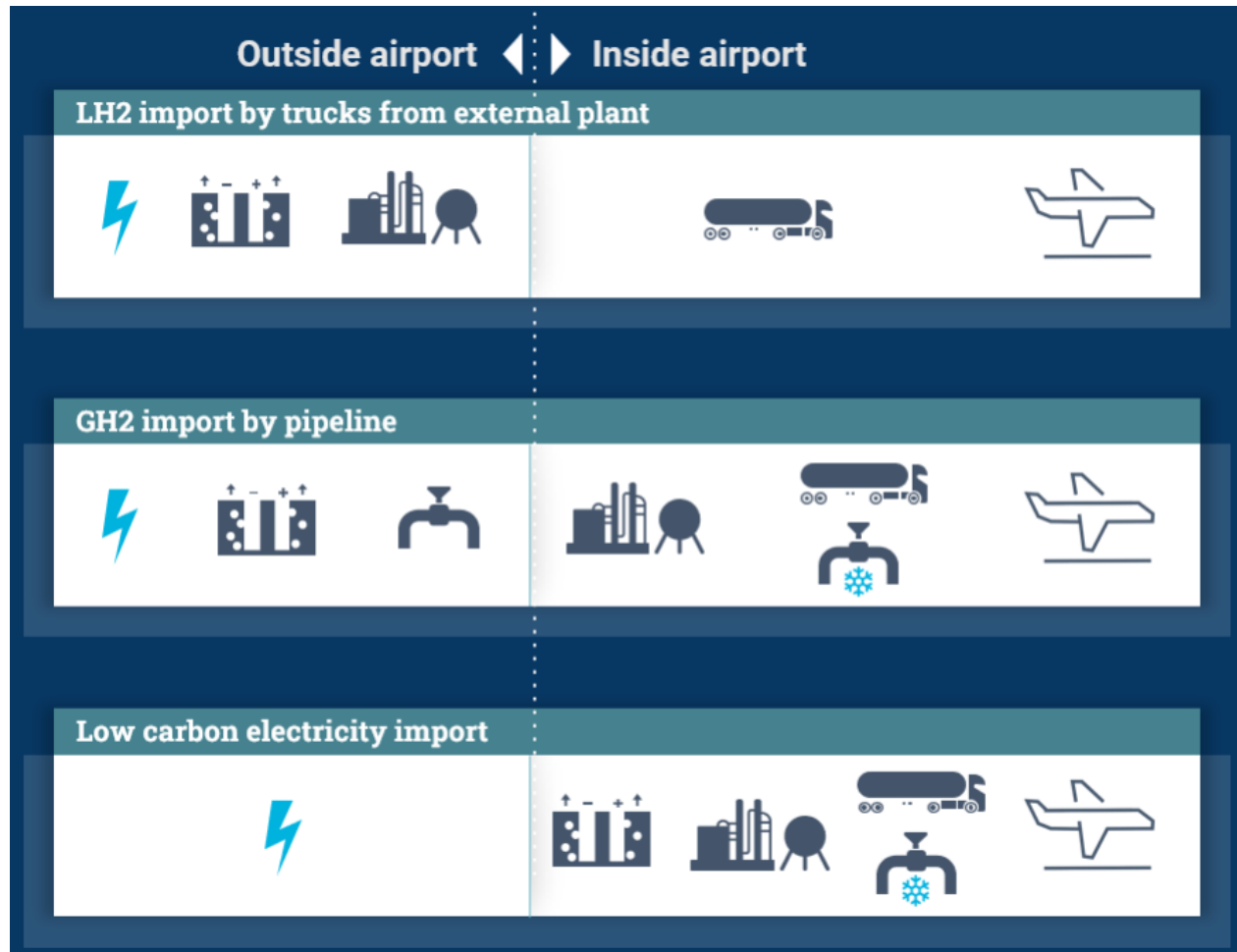


Figure 19 : Supply chains for H2-ready airports

9 Interaction of the Three Certification Levers with Existing Airport Certifications

In part E, were presented various certifications that can be important for airports, including Airport Carbon Accreditation (ACA, ACI Europe/World), Leadership in Energy and Environmental Design



(LEED) or Building Research Establishment Environmental Assessment Method (BREEAM). These certifications are key to ensuring that airports operate sustainably, efficiently, and in compliance with regulatory standards, laying a solid foundation for environmentally responsible and operationally excellent airport management.

In part 6, 7 and 8, we presented three innovative certification levers designed to further improve airport sustainability and operational excellence: Waste to Biofuel for Vehicles, Sustainable Aviation Fuels (SAF) for Aircraft Fuels and Hydrogen (H₂) for Aircraft Fuels. By incorporating these solutions, airports can achieve superior levels of environmental performance, operational efficiency, and regulatory compliance.

In this part, the focus will be on how to manage all of the certifications presented above, integrating the new sustainability levers: Waste to Biofuel, Hydrogen (H₂), and SAF. This section will focus on the three possible scenarios for incorporating these new criteria into the existing certification frameworks.

9.1 Modifying Existing Certifications to Include New Criteria

One effective approach to integrating new sustainability criteria into airport management is to modify existing certifications.

By expanding current frameworks, airports can adopt a more comprehensive approach to sustainability. For instance, Airport Carbon Accreditation (ACA) could be enhanced to include criteria for the use of Hydrogen (H₂) and Sustainable Aviation Fuels (SAF) in aircraft operations, as well as the conversion of waste to biofuel for ground vehicles. This would broaden the certification's scope and relevance, aligning it with modern sustainability goals. Additionally, ISO Standards such as ISO 14001 (Environmental Management) and ISO 50001 (Energy Management) could be updated to include specific requirements and guidelines for managing these new sustainability initiatives.

Advantages and limitations

This approach offers several advantages. First, it provides a **comprehensive approach** to sustainability by integrating new criteria into established frameworks. Airports that meet these enhanced standards would gain greater recognition for their sustainability efforts, reinforcing their commitment to environmental responsibility. Furthermore, modifying existing certifications can unify compliance, making it easier for airports to adopt new sustainability practices without the need for entirely new certification processes.

However, this approach also has its challenges. Adding new criteria can **increase the complexity** of the certification process, and there may be additional costs associated with updating standards and training auditors. Additionally, the process of modifying and implementing new criteria can be time-consuming, requiring careful planning and coordination.



9.2 Creating Separate Certification Systems

Another scenario for integrating the new levers into airport management is to create and adopt entirely new certification standards tailored specifically to Waste to Biofuel, Hydrogen (H₂), and SAF. These new standards would focus exclusively on these innovative sustainability initiatives, providing a specialized and detailed framework to address their unique challenges and opportunities.

Advantages and limitations

This approach offers several advantages. First, it provides a **specialized focus**, allowing for a more detailed assessment of the lever. By creating standards that are specifically designed for these initiatives, airports can ensure that their efforts in these areas are properly recognized and validated. They also offer **flexibility**, as they can be adapted to the specific needs and challenges of each sustainability lever, rather than being constrained by the broader scope of existing certifications.

However, this approach also presents disadvantages. Having a lot of certifications is a significant concern, as airports would need to be able to obtain and maintain them, which can be resource-intensive and time-consuming. There may also be **additional costs** associated with developing, implementing, and maintaining these new certification systems. Furthermore, managing multiple certification systems can **multiply administrative and operational procedures**, increasing the complexity of compliance efforts. Finally, this approach could lead to regulatory fragmentation, as the European Commission may not have oversight over all aspects of the new certifications, potentially resulting in inconsistent standards and reduced regulatory coherence.

9.3 Unified Certification Under European Commission Oversight

A third scenario for the sustainability in airport management is to unify all sustainability criteria under a single certification framework overseen by the European Commission. This approach involves creating a single comprehensive certification that embraces both existing (LEED, ACA, BREEAM) and new sustainability criteria (Waste to Biofuel for Vehicles, Hydrogen, and SAF).

Advantages and limitations

This unified certification offers advantages. First, **centralized oversight by the European Commission** would ensure uniform standards and compliance across all sustainability aspects, providing a consistent and reliable framework for airports. Additionally, airports would only need to obtain **one certification**, facilitating the compliance process and reducing the administrative burden associated with managing multiple certifications.

However, this approach also presents certain challenges. A unified certification could **shadow existing certifications**, potentially diminishing their value and recognition. Furthermore, creating a unified certification framework would be **complex** and resource-intensive, requiring significant time and effort to develop and implement. Finally, regulatory control by the European Commission may not be desirable for all stakeholders, as it would **concentrate decision-making power in a single entity**, potentially limiting flexibility and adaptability.



10 Implementation, Roadmap & Continuous Improvement

To ensure a successful transition towards sustainable aviation, it is crucial to choose from the 3 scenarios presented previously. This will help define a suitable roadmap with clear short-term, medium-term, and long-term goals. This section provides recommendations for each timeframe, taking into account the implementation process and the roadmap, which will depend on the strategy chosen in the previous section.

We will assume that the easiest strategy to implement is to have separate certification systems (option 9.2 of last section).

10.1 Implementation of certification schemes

The implementation of certification schemes represents a crucial step in promoting sustainability and technological innovation at airports, particularly for the introduction of hydrogen SAF or biofuels as alternative energy sources. These certification schemes, which may cover environmental, energy, safety, or sustainable management aspects, enable airports to systematically monitor and verify their performance, identify areas for improvement, and ensure compliance with international standards and national regulations. In the context of sustainability, certifications help reduce the overall environmental impact of airport operations, promote efficient management of energy, waste, CO₂ emissions, and encourage the adoption of innovative practices, such as the use of green hydrogen for ground vehicles or HVAC systems.

The adoption of alternative fuels certifications is equally critical, as it ensures that facilities are designed, constructed, and operated according to rigorous safety requirements for hydrogen storage and refueling, reducing operational risks and increasing confidence among operators and passengers. The implementation of these schemes typically follows a sequence of key steps, including:

- **Preliminary assessment**: evaluating the current state of airport infrastructure and operations against relevant standards.
- **Definition of objectives and requirements**: identifying areas for improvement and setting the specific targets.
- **Development of processes and procedures**: establishing operational protocols, monitoring systems, and environmental or energy management tools.
- **Personnel training and auditor preparation**: comprehensive training of internal auditors is essential, ensuring they are proficient in certification standards (environmental, energy, hydrogen-ready) as well as audit and reporting procedures. This phase typically includes practical exercises, simulations, and updates on applicable regulations.
- **Audits and verification**: conducting internal checks to be continuously prepared for the official external audits regularly certification bodies to obtain official certification.



- **Monitoring and continuous improvement:** collecting data, analyzing results, and updating processes to maintain certification and optimize performance over time.

It is worth noting that, the implementation of certification schemes is not only a tool for control and verification but also a strategic lever to accelerate the transition to more sustainable airports, fostering technological innovation, safety, and environmental responsibility. The combination of clear standards, well-defined processes, and qualified personnel ensures that airports can operate efficiently and safely while minimizing environmental impact and preparing for the widespread adoption of hydrogen technologies.

10.2 Short-term (1–3 years):

In the short term, the primary focus should be on **initial assessment, planning, and stakeholder engagement**. Conducting a gap analysis will help assess current sustainability practices and identify gaps in relation to the new certification standards for Waste to Biofuel, Hydrogen, and SAF. The focus should also be on choosing which certifications suit the airport the best.

This can go through developing a detailed implementation plan outlining the steps, resources, and timelines required to achieve these new certifications is essential. Engaging both internal stakeholders, such as airport management and operational staff, and external stakeholders, including airlines and regulatory bodies, will ensure buy-in and collaboration. Launching small-scale pilot programs to test the feasibility of new sustainability initiatives and monitoring their progress will provide valuable data and feedback. Additionally, training airport staff on the new certification standards and raising awareness about the importance of these certifications will foster a culture of sustainability.

10.3 Medium-term (3–7 years):

In the medium term, the focus shifts to **scaling up implementation and obtaining certifications**. Expanding successful pilot projects across the airport and integrating new sustainability initiatives with existing systems. Preparing for audits by gathering documentation and conducting internal audits will help obtain the new sustainability certifications. Establishing key performance indicators (KPIs) to monitor progress and continuously improving sustainability practices based on data and feedback will drive ongoing success. Regularly publishing sustainability reports and communicating progress to stakeholders will maintain transparency and engagement.

10.4 Long-term (7–15 years):

In the long term, the goal is to **achieve full certification and compliance**, drive innovation, and align with broader sustainability goals. Ensuring that the airport meets all certification requirements and maintaining compliance through regular audits and updates will solidify sustainability efforts. Investing in research and development to explore new technologies and practices will position the airport as a leader in sustainable aviation. Aligning sustainability initiatives with global standards,



and contributing to industry-wide goals, like net-zero emissions by 2050, will further enhance the airport's sustainability profile. Collaborating with local communities, governments, NGOs, airlines, and industry partners will support collective progress towards sustainable aviation.

10.5 Key Performance Indicators (KPIs) for the implementation of Certification Schemes

The effective implementation of environmental and sustainability certification schemes in the airport sector requires not only a clear definition of technical and procedural requirements, but also a structured system of Key Performance Indicators (KPIs) capable of monitoring progress, quality, and the effectiveness of the actions undertaken over time.

In alignment with the process described in Chapter D, “Steps to Achieve Certification,” KPIs represent an essential tool for translating certification objectives into measurable, verifiable, and audit-ready outcomes, while simultaneously supporting strategic decision-making and continuous improvement.

This chapter proposes a set of KPIs structured according to a temporal framework (short-, mid-, and long-term) and directly linked to the different stages of the certification pathway, from the initial assessment through to certification achievement and maintenance. This approach enables airports to adapt the maturity level of monitoring to their specific stage of development, while maintaining consistency with existing and future certification schemes.

Baseline Assessment

Short term (1–3 years)

- **Percentage of airport perimeter covered by baseline audits (Scope 1, 2 and relevant Scope 3)**
This KPI measures the extent to which the airport has assessed its initial environmental impacts. Incomplete coverage indicates a weak baseline and may undermine the reliability of subsequent planning and certification phases.
- **Completion of GHG emissions inventory**
The availability of a structured and comprehensive greenhouse gas emissions inventory is a fundamental prerequisite for any climate-related certification scheme and represents the reference point for future monitoring and performance tracking.
- **Availability and consistency of baseline data (energy, water, waste)**
This indicator assesses whether baseline data are available, coherent, and comparable on an annual basis, thereby reducing the risk of inconsistencies during audits and verification activities.

Mid term (3–7 years)

- **Reduction of data gaps and uncertainty in baseline assessments**
As the certification pathway progresses, the focus shifts from basic data collection to improving data quality, accuracy, and continuity over time.



- **Integration of baseline results into EMS / EnMS systems**

Integration into ISO-based Environmental and Energy Management Systems demonstrates that the baseline has evolved from a one-off exercise into an operational decision-support tool.

Long term (7–15 years)

- **Use of baseline as a long-term reference for decarbonization pathways**

In the long term, the baseline becomes a consolidated historical reference used to assess progress toward strategic objectives such as climate neutrality and to support cost–benefit analyses and long-term investment decisions.

Gap Analysis vs. Certification Requirements

Short term (1–3 years)

- **Percentage of certification requirements assessed**

This KPI measures the level of understanding of the selected certification scheme and represents the first indicator of process maturity.

- **Number of identified gaps classified by criticality**

Classifying gaps according to criticality (high, medium, low) enables effective prioritization of actions and optimized allocation of resources.

Mid- term (3–7 years)

- **Percentage of gaps covered by approved action plans**

This indicator verifies that the gap analysis is effectively translated into structured and management-approved action plans.

- **Average time to close critical gaps**

The time required to close major non-conformities is a clear indicator of the airport's organizational effectiveness and decision-making capability.

Long term (7–15 years)

- **Sustained compliance with evolving certification requirements**

Over the long term, this KPI measures the airport's ability not only to achieve compliance, but also to remain aligned with regulatory evolution and updates to certification standards.

Action Planning

Short term (1–3 years)

- **Percentage of actions with defined KPIs, responsibilities, and timelines**

This KPI assesses the robustness of the action plan, ensuring that each action is measurable, clearly assigned, and time-bound.



- **Alignment of action plans with certification objectives**

The objective is to avoid action plans that are disconnected from certification requirements, thereby ensuring strategic coherence.

Mid term (3–7 years)

- **Implementation rate of planned actions**

Monitoring implementation progress helps identify delays or bottlenecks and supports timely re-prioritization of operational activities.

- **Deviation between planned and actual performance**

This indicator provides valuable insight into planning reliability and execution capability.

Long term (7–15 years)

- **Stability and adaptability of the action planning framework**

In the long term, this KPI measures the ability of the planning framework to evolve and integrate new requirements, such as SAF, hydrogen, or emerging certification schemes.

Implementation

Short term (1–3 years)

- **Percentage of actions effectively launched**

This KPI verifies that implementation has genuinely started and has not remained at a purely planning level.

- **Percentage of staff trained on certification requirements**

Training is a critical success factor; low training coverage indicates increased risk during audits and verification processes.

Mid term (3–7 years)

- **Reduction in energy consumption and GHG emissions compared to baseline**

These KPIs measure the tangible environmental benefits of implemented actions, going beyond documentary compliance.

- **Share of ground fleet converted to low-carbon fuels**

A key indicator for assessing the operational impact of decarbonization strategies.

Long term (7–15 years)

- **Durability and resilience of implemented solutions**

Over the long term, the focus is on the ability of implemented solutions to remain effective, safe, and compliant despite evolving requirements or technologies.

Monitoring & Reporting

Short term (1–3 years)



- **Percentage of KPIs monitored and reported on a regular basis**
This indicator verifies that the monitoring system is operational and not merely defined at a conceptual level.
- **Data reliability and verification rate**
Data quality is essential to ensure credibility with certification bodies and external stakeholders.

Mid term (3–7 years)

- **Trend improvement of key sustainability indicators**
Trend analysis enables evaluation of action effectiveness over time and supports continuous improvement.
- **Integration of reporting with certification schemes**
Integrated reporting reduces duplication and increases overall management efficiency.

Long term (7–15 years)

- **Use of monitoring results for strategic decision-making**
In the long term, KPIs become a strategic management tool, supporting investment decisions, long-term planning, and ESG reporting.

Certification Application & Audit

Short term (1–3 years)

- **Number of certifications applied for and successfully obtained**
This KPI measures the tangible outcome of the certification pathway.
- **Number and severity of non-conformities identified during audits**
Non-conformities provide a direct indication of system maturity.

Mid term (3–7 years)

- **Reduction of non-conformities over successive audits**
A progressive reduction in non-conformities indicates structural and sustained improvement.
- **Average time to close audit findings**
Short response times reflect an effective and well-controlled organization.

Long term (7–15 years)

- **Continuity and credibility of certification over time**
This KPI assesses the airport's ability to maintain certification in the long term, strengthening trust among stakeholders, investors, and authorities.

11 Tools and Best Practices



11.1 Energy Management Systems (EMS)

An EMS is a system that monitors, controls, and optimizes energy use in buildings and facilities. By using an EMS, airports can identify areas for energy efficiency improvements, reduce their energy costs, and improve their overall energy efficiency.

11.2 Environmental Management System (EnMS)

EnMS provides a structured framework for environmental management, including monitoring emissions, energy consumption, waste management, and environmental risk control. Examples could include: ISO 14001, EMAS (Eco-Management and Audit Scheme)

11.3 Digital twins for airport operations

A digital twin is a virtual replica of a physical system or process. By using digital twins for airport operations, airports can simulate and optimize their operations, identify areas for improvement, and reduce their environmental impact. Digital twins can also help airports prepare for emergencies and respond to disruptions more effectively.

11.4 Green procurement policies

Green procurement policies prioritize the use of environmentally friendly products and services. By implementing green procurement policies, airports can reduce their environmental impact, support sustainable supply chains, and promote sustainability in the aviation industry. For example, airports can prioritize the use of recycled materials, source products and services from local suppliers, and choose products and services with lower embodied energy and carbon footprints.

11.5 Examples

Amsterdam Schiphol: Amsterdam Schiphol has implemented a comprehensive sustainability program, including an energy management system, renewable energy sources, and green procurement policies. Schiphol has achieved Level 4+ in the Airport Carbon Accreditation program, which recognizes airports that have reduced their carbon emissions.

Oslo Gardermoen: Oslo Gardermoen has achieved carbon neutrality (Level 3+) by implementing a range of sustainability measures, including renewable energy sources, energy efficiency improvements, and green procurement policies.

Charles de Gaulle Airport: Charles de Gaulle Airport in Paris has implemented a range of sustainability measures, including an energy management system, renewable energy sources, and green procurement policies. CDG has also implemented a comprehensive waste management system.



12 Conclusion

Using alternative fuels for onsite vehicles is a decarbonization lever that cannot be ignored. Crigen waste-to-biofuel project shows that the technical solution for fuels supply can exist for airports. However, these fuels shall respect two aspects :

- They must be sustainable and bring a net environmental impact.
- They must be technically compatible with the vehicles used by the airports.

European legislation already addresses the first criterion through the Renewable Energy Directive (RED), which provides a framework for assessing the sustainability of fuels and verifying their greenhouse gas (GHG) emission savings compared with fossil fuel references.

The second criterion was examined during the OLGA workshop held in 2024. The conclusions showed that airport ground vehicles do not require specific technical properties that differ from those of conventional road vehicles. As a result, no additional dedicated certification scheme appears to be necessary.

In this context, the need to combine sustainability and technical requirements for airport vehicle fuels was discussed. Several implementation options were identified, including existing frameworks and organizations such as Airport Carbon Accreditation, ISO standards, or a dedicated European regulatory framework managed by the European Commission. Each option presents its own advantages and limitations in terms of governance, implementation effort, and stakeholder acceptance.

Finally, emissions from airport ground operations represent only a small share of total aviation emissions, the vast majority of which are generated by aircraft fuel consumption. Consequently, major decarbonization levers for the aviation sector, such as Sustainable Aviation Fuels (SAF) and hydrogen, were also briefly presented.

Regarding the next steps, airports should now define their strategy for the decarbonization of their vehicle fleets, as well as for the deployment of infrastructure supporting alternative aircraft fuels. All relevant stakeholders should be involved and informed throughout this process, as such strategic decisions may have a significant impact on airport operations and activities.



13 References & Resources

- [1]. **RED II: DIRECTIVE (EU) 2018/2001 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 11 December 2018 on the promotion of the use of energy from renewable sources, Official Journal of the European Union, 2018.
- [2]. **RED III: DIRECTIVE (EU) 2023/2413 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652, Official Journal of the European Union, 2018
- [3]. **Waste Framework Directive (WFD): DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL** of 19 November 2008 on waste and repealing certain Directives, Official Journal of the European Union, 2008
- [4]. **ACI Airport Carbon Accreditation guidelines**
- [5]. **LEED & BREEAM manuals**
- [6]. **ISO 14001/50001 standards**
- [7]. **EU Green Deal & Fit for 55 aviation targets**
- [8]. **OLGA D5.3 : H2 Aircraft-Airport compatibility checklist and H2 masterplan structure for future replication (Version 31/12/2025)**