ALIGHT
SUSTAINABLE AVIATION

Detailed report of the local/national regulatory compliance for delivering SAF in the fellow airports, and in other Airports

D 9.4

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Abbreviation	Extended name
ADR	Aeroporti di Roma
AMS	Amsterdam Schiphol Airport
ASTM	American Society for Testing and Materials
BRS	Bristol Airport
BRU	Brussels Zaventem Airport
CPH	Copenhagen Airport
CPK	Warsaw Airport
ETS	Emissions Trading System
FCO	Rome Fiumicino ''Leonardo da Vinci'' Airport
GHG	Greenhouse Gas
ICN	Incheon International Airport
LCAF	Lower Carbon Aviation Fuels
LHR	London Heathrow Airport
LTOU	Lithuanian Airports
NZE	Net Zero Emissions
PNIEC	Piano Nazionale Integrato per l'Energia e il Clima
RLCF	Renewable and Low-Carbon Fuels Value Chain Industrial Alliance
SAF	Sustainable Aviation Fuel
SFO	San Francisco International Airport
SIN	Singapore Changi Airport
VNO	Vilnius International Airport

Executive summary

The implementation of Sustainable Aviation Fuel (SAF), in accordance with the regulations established by the ReFuelEU Aviation framework, requires compliance from all airports within the European Union. Each airport must adapt the obligations defined by the regulatory framework to its local context.

In the journey towards greater airport sustainability, in addition to the integration of SAF, both the airport transportation system and initiatives in support of the local community play a fundamental role. These elements are essential to ensure a comprehensive approach to decarbonization and the reduction of the environmental impact of airports.

This document analyzes how the partner airports of Deliverable 9.4 of the ALIGHT project have implemented the regulatory framework and integrated it into their respective national contexts. Beyond complying with European directives for the adoption of SAF, airports also have the responsibility to develop an efficient and sustainable transportation system, in collaboration with local authorities. At the same time, their commitment to sustainability extends to initiatives supporting local communities, helping to reduce the environmental and social impact of airport operations.

Airports play a key role in implementing regulatory obligations, ensuring compliance with European requirements, developing sustainable transportation systems, reducing emissions associated with airport mobility, supporting local communities, through projects aimed at environmental protection and improving the quality of life in surrounding areas.

The document is divided into four chapters, each focusing on a key aspect of SAF integration and airport sustainability:

Chapter 1: provides a comprehensive overview of the European regulatory framework for integrating SAF into airports. It also examines the sustainable development plans adopted by different countries, highlighting the targets and objectives set at the national level.

Chapter 2: analyzes the airport transportation system in four reference airports: Copenhagen (Lighthouse Airport), Rome Fiumicino, Vilnius, and Warsaw. This chapter describes the main transport methods used to access these airports, their associated emissions, and each airport's strategies to enhance sustainability and efficiency.

Chapter 3: showcases the initiatives adopted by airports to support local communities. It explores interventions for noise pollution reduction, projects related to biodiversity, and measures aimed at preserving the surrounding environment.

Chapter 4: highlights best practices and innovative solutions implemented by other international airports, providing concrete examples for each theme covered in the previous chapters.

Finally, the study's conclusions, structured according to the approach outlined above, are presented in Chapter 5.

Introduction

In October 2023 the EU Commission adopt the **ReFuelEU Aviation**, a regulation that aims to promote the adoption of renewable and low-carbon fuels, reducing the environmental impact of aviation. The ReFuelEU Aviation is part of the Fit-for-55 package, designed to cut EU greenhouse gas emissions by at least 55% by 2030.

To support the achievement of these goals, the European Union has introduced a set of regulatory, financial, and operational support mechanisms.

The EU has allocated financial resources through programs like Horizon Europe, the Innovation Fund, and InvestEU. These initiatives are designed to support the entire lifecycle of Sustainable Aviation Fuel (SAF) production, addressing technological and financial risks at every stage.

The success of the ReFuelEU Aviation strategy, however, is related to how individual Member States implement these regulations and adapt them to their **national and local contexts**. Each country will need to establish clear frameworks and infrastructure to facilitate SAF production, blending, and distribution, taking into account their unique context, including technological capacity, industrial expertise, and aviation market dynamics.

The regional implementation of SAF policies will require close collaboration between national governments, local authorities, industry stakeholders, and academic institutions. Countries with advanced refining capabilities may prioritize scaling up SAF production domestically, while others may focus on importing SAF or investing in synthetic fuel technologies. Ensuring the alignment of these diverse approaches will be critical to maintaining a level playing field within the Union and achieving the overall climate objectives.

Another aspect to consider is the development of the **transportation system** and its integration with airport operations. Modern airports are going to be a key node for regional and national transport networks. Efficient connectivity between airports and other modes of transport, such as rail, road, and public transit, is essential to reduce travel times, improve accessibility, and promote sustainable mobility solutions.

Moreover, airports significantly contribute to **community development** by using energy services or improving the production and use of renewable energy, playing a central role for regional development. Their strategic planning and investments must address community needs, ensuring that development initiatives are aligned with environmental and social sustainability goals.

The necessary information was gathered from the airport management institutions themselves, who kindly cooperated by sharing compiled surveys on the key points to be discussed. Specifically, the surveys focused on:

- Current local and national regulatory context and objectives
- SAFs adoption in airports: gaps, constraints and plans.
- Targets, both legislative and in terms of airport development plans.

The information related to Warsaw Airport pertains to a facility that is not yet operational and is still under construction, awaiting completion before it can commence activities.

1 Local and National SAF regulation context

This chapter analyses the European regulatory framework that includes the main directives related to the introduction of SAFs, such as the RueFuelEU aviation, the EU ETS Directive and RED II. For each Partner airport, it will be described how these directives have been transposed at national level and whether there are national frameworks to be considered for the introduction of SAF.

1.1 EU and International regulation

The ReFuelEU Aviation Regulation is one of the reforms included in the package Fit-for-55, a mechanism with the goal of reducing greenhouse gas emissions in all sectors by at least 55% by 2030 compared to 1990 levels[1].

The ReFuelEU Aviation regulation will oblige fuel suppliers at EU airports to gradually increase the share of SAF and e-SAF (synthetic fuels) that they distribute. The regulation mandates that, starting in 2025, aviation fuel suppliers must ensure a minimum of 2% share of supply SAF at all Union airports. This mandatory share percentage will increase progressively, aiming to reach at least 70% by 2050. In parallel, e-SAF are subject to a separate and dedicated minimum share. The targets for these advanced fuels begin with 1.2% in 2030, increase to 2% in 2032, and culminate in 35% by 2050.

The mandatory minimum quotas of Sustainable Aviation Fuels (SAF) set by the ReFuelEU Aviation are reported in the table below.

	2025	2030	2032	2035	2040	2045	2050
Percentage of SAF used in air transport:	2%	6%	6%	20%	34%	42%	70%
Of which: sub-mandate Synthetic fuels (or e-fuels):	-	0.7%	1.2%	5%	10%	15%	35%

Table 1- SAF blending goals up to 2050. Credit: www.easa.europa.eu/en/light/topics/fit-55-and-refueleu-aviation

Another obligation in the ReFuelEU Aviation is the **anti-tankering** practice (carrying extra fuel to avoid refuelling at destination airport where fuel is more expensive), in order to avoid emissions related to extra weight. The Regulation oblige also the EU airports to guarantee the necessary infrastructure to deliver, store and refuel with SAF.

Inside the Fit-for-55 package, there are other relevant measures, as the Renewable Energy Directive (RED), that defines the requirements for feedstocks used to produce SAF and the methodologies for the Life Cycle Assessment of fuels, essentially evaluating their environmental sustainability. Additionally, the Emissions Trading System (ETS) Directive establishes a scheme for the trading of greenhouse gas emissions allowances in the sectors of air and maritime transportation, and stationary installations. The ETS Directive introduces a cap-and trade mechanism to link emissions produced or avoided to cost or revenue items, respectively. This Directive is

particularly importance for SAF, as Directive 2023/958 mandates that, during the period 2024–2030, up to 20 million allowances will be allocated to aircraft operators utilizing non-fossil fuels.

Other relevant measure is the Renewable and Low-Carbon Fuels Value Chain Industrial Alliance (RLCF), the Alliance for Zero Emission Aviation, and the "European Clearing House for Sustainable Aviation Fuels (SAF)", an initiative managed by EASA that aims to identify, by means of public tender subjects able to support the certification of SAF deriving from feedstocks and production processes not yet included in the certified paths.

The main reforms of the 'Fit-for-55' package described, are represented in Figure 1.

Figure 1 - Reforms of the 'Fit-for-55' package (source: European Commission)[2]

The RED II and ReFuelEU Aviation are the main regulations that define the European regulatory framework for Sustainable Aviation Fuels (SAF). RED II defines the minimum reduction in greenhouse gas (GHG) emissions for SAF compared to fossil fuels, while ReFuelEU Aviation introduces targets for SAF supply and use for all the main stakeholders (fuel suppliers, airline operators and major EU airports).

Other relevant regulations and standards include the **ASTM** standard, which defines the certification and usage criteria for sustainable aviation fuels, and **CORSIA** (Carbon Offsetting and Reduction Scheme for International Aviation), the ICAO's global mechanism aimed at offsetting and reducing CO_2 emissions in the aviation sector using sustainable fuels and emission compensation measures.

1.2 Description of local and national SAF regulation

The following sections will discuss the regulatory frameworks adopted by the countries and regions where airports are located, possibly including the topic of introducing SAFs.

In each case, the main stakeholders involved include air operators, airport managers, fuel supply chain players (producers, distributors, and handlers), aircraft manufacturers, universities and research institutions, as well as industry associations.

1.2.1 Copenhagen airport (CPH)

Denmark is adopting a more efficient climate model by 2030, in line with the Fit for 55 package and the strengthening of the EU ETS. Its emission reduction targets in the non-ETS sectors (agriculture, road transport, and buildings) have been increased from 39% to 50% compared to

2005 levels. In the aviation sector, Denmark has supported the extension of the ETS exemption for extra-EU flights until 2027 and the gradual phase-out of free allowances by 2026. Additionally, it has promoted stricter SAF blending requirements starting in 2025 and a 100% emissions reduction for new cars and vans by 2035, with a 90% target for heavy-duty vehicles by 2040. Finally, under the REPowerEU package, Denmark contributes to the EU's goals of increasing the share of renewables to at least 42.5% by 2030 and reducing energy consumption by 11.7% compared to the Commission's baseline projections[3].

Category	Denmark's Climate Actions
Non-ETS Sectors	Emission reduction target increased from 39% to 50% by 2030 (compared to 2005) in agriculture, road transport, and buildings.
ETS Sectors	Supported ETS exemption for extra-EU flights until 2027 and phase-out of free allowances by 2026.
SAF Blending (ETS)	Stricter blending requirements starting in 2025.
Automotive Sector (Non-ETS)	100% emission reduction for new cars and vans by 2035 90% reduction for heavy-duty vehicles by 2040.
Renewable Energy (ETS & Non-ETS)	42.5% renewables by 2030 under REPowerEU.
Energy Consumption Reduction (ETS & Non-ETS)	11.7% reduction compared to the Commission's baseline projections.

Table 2 - Denmark ETS targets

In Denmark to date, no specific regulatory framework has been published regarding the adoption and integration of SAFs, referring for its implementation to the guidelines outlined by the EU Commission's proposed ReFuelEU, with no deviations and maintaining the same reference targets for mandatory sustainable fuel quotas from 2025.

CPH Airport is showing commitment to the Danish Climate Partnership for Aviation. This regards the introduction by the Danish government, in order to be able to finance the project of reaching the net-zero goal in 2050 and net-zero for domestic flights by 2030, of a tax of 100 Danish kroner per passenger in domestic air transport in 2023. This process started by a law proposal (nr. 620, June 11th, 2024) by the Danish Parliament. This would first achieve the goal of getting the first green domestic route in air transport by 2025, then using it as a pathfinder to make other domestic routes "green" by the year 2030. For this purpose, there is a fund of 550 million Danish kroner to support green transition from 2025 to 2030, and 450 million more from 2030 to 2033. The monitoring of the achievements is managed by Danish Civil Aviation Authority, which will publish an annual technical report on the progress of the goal, as outlined in Article 13 of the legislative reference[4].

The phasing-in of SAFs is crucial for achieving these goals: CPH is engaged in several initiatives to strengthen the supply of SAF. In 2023, DCC & Shell Aviation Denmark established Denmark's first large store (10 million litres) of biobased fuel on the island of Prøvestenen, where the

airport's fuel supply is located. Air Greenland decided to become the first airline to contribute by filling a proportion of SAF in the tank at CPH, equivalent to 5% of the fuel consumption on the route between Sønderstrømfjord/Kangerlussuaq and Copenhagen.

The target set for Danish aviation sector is primarily aligned with the one set by the ReFuelEU regulation, expecting almost 2% SAF usage in the fuel mixture by 2025 and almost 6% by 2030. As regards decarbonization targets, ReFuelEU is also the only regulatory reference, expecting overall emissions reduction by 55% in 2030 (compared with 1990 emissions) and net-zero in 2050. By 2030, CPH foresees to achieve net zero emissions from its operations, buildings leased to other parties, ground handling and surface access transportation to and from the airport.

1.2.2 **Fiumicino Airport (FCO)**

Italy fully shares the Community's approach to strengthening efforts to decarbonize Europe's energy and economic systems and to bring Europe to be the first regional area to have a social, economic and productive dimension entirely to net zero emissions, also with a view to achieving international leadership in this sector and thus leading other world economies.

The following table is part of NECP and sets out the main 2030 targets of the plan on greenhouse gas emissions[5].

GHG emissions and removals	NECP 2024- reference case	FF55 RePower EU objectives
GHG reduction vs 2005 for all installations bound by ETS legislation	-58%	— 62 % 6
GHG reduction vs 2005 for all ESR sectors	-29.3 %	— 43.7 %7, 8
GHG emissions and removals from LULUCF	-28.4 $MtCO_2eq$	-35.8 $MtCO_2eq$

Table 3 - Italy targets for 2030

Regarding Fiumicino Airport, most of the technical standards and regulations in place at the European level and the ReFuelEU regulations targets, are transposed equivalently by Member States, resulting in homogeneity in the ultimate goals and the tools to be used to achieve them. On the other hand, standards can be transposed and rearranged to achieve a more challenging and competitive level of engineering and carbon footprint outcomes than those achieved by other Member States.

A practical example can be found in the Italian national regulatory evolution, where the Directive 2018/2001 (RED II) has been incorporated through Legislative Decree No. 199 of November 8, 2021, which came into effect on December 15, 2021.

As noted above, the ReFuelEU Aviation Regulation at the national level is directly applicable, without the need for transposition, but different regulations must be considered, particularly when selecting areas for airport developments at the permitting stage. If new infrastructure or facilities need to be built to meet the requirements of the proposed scenarios, an

environmental impact assessment and an evaluation of compatibility with existing activities in the area may be necessary.

Specifically, the most relevant regulations tied to the airport at national level are the following:

- EASA and ENAC (Italian Civil Aviation Authority) rules regarding obstacles, buffer zones, and runway strips
- ENAC regulations on obstacles and hazards
- Airport Master Plan, a document that reports the development plan for the Airport
- Regional Landscape Territorial Plan including all the rules and constraints to be observed for the construction of infrastructure with respect to geographic location, to minimize the visual, acoustic and environmental impact on the surrounding area
- Natural Parks regulations: these include constraints imposed on works that are intended to be carried out within the boundary of the area of a natural oasis, with the aim of preserving its ecosystems and biological balance
- Lazio Region Flood Risk Management Plan (PAI): regulatory plan to minimize flood risks in the territorial relevance of the Lazio region.

Regulatory compliance is maintained across various levels, aligning national and regional standards with overarching EU policies while addressing the unique challenges of specific development contexts.

The Italian institutions mainly involved in the sustainability of aviation sector are currently the Ministry of Infrastructure and Transport (MIT), the Ministry of the Environment and Energy Security (MASE), and the National Civil Aviation Authority (ENAC). Since 2019, ENAC has been working on the establishment of a National SAF Observatory, in collaboration with MIT, MASE, and relevant stakeholders. The primary objectives of the Observatory are to share knowledge on SAF and facilitate dialogue among stakeholders to analyse sector challenges and propose new initiatives.

The production, storage, and use of SAF in Italy are not governed by specific decrees. Instead, SAF falls under the broader category of fuels and flammable liquids, which are included in general fire prevention decrees (main reference is the D.M. of July 31, 1934). Given the historical approach to fire prevention regulations in Italy, it is unlikely that a dedicated SAF-specific decree will be issued, as SAF shares many characteristics with other flammable substances typically treated under unified standards[6].

In this context, Fiumicino Airport's goal is to reach Net Zero CO_2 emissions by 2030, not only by introducing SAF at the airport, but also by implementing the following initiatives, which represent only a part of the strategy developed for Net Zero:

- Energy efficiency
- Installation of photovoltaic plants
- Source of renewable energy
- Fleet electrification
- Use of biofuels.

1.2.3 **Vilnius Airport (VNO)**

Lithuania has set ambitious targets for reducing greenhouse gas emissions by 2030, 2040, and 2050. Compared to 1990 levels, emissions should decrease by at least 70% by 2030, 85% by 2040, and reach net-zero by 2050. When compared to 2005 levels, the overall reduction target is 40% by 2030. The sectors covered by the EU ETS must achieve a reduction of at least 55%, while non-ETS sectors are expected to reduce emissions by 40% compared to 2005. Excluding removals from the FNM sector, the reduction must still reach at least 21% compared to 2005. Climate change mitigation efforts focus on emissions reductions in agriculture, energy, transport, industry, and waste management. In non-ETS sectors, between 2016 and 2018, transport emissions were 36.2% higher than in 2005, industry emissions increased by 32.5%, and emissions from agriculture, waste, and small energy sources rose by 3.6%, 36.6%, and 50.8%, respectively. The targets set for 2025 and 2030 reflect a commitment to reversing these trends and aligning with the broader decarbonization objectives[7].

Category	By 2030	By 2040	Final Target
Reduction compared to 1990 levels	≥ 70%	85%	100%
Reduction compared to 2005 levels	≥ 30%	—	—
Reduction in ETS-covered sectors	≥ 55%	—	—
Reduction in non-ETS sectors	≥ 25%	—	—

Table 4 - Lithuania ETS targets

The Lithuanian energy and aviation regulatory framework are undergoing significant development to align with European and national sustainability goals, while the provisions defined by ReFuelEU on aviation are currently being transposed into national legislation with the draft law under review.

With regard to SAF, from a logistical point of view the basic aviation fuel infrastructure at VNO is operated by UAB Baltjet under a long-term lease agreement. These companies manage the entire fuel base infrastructure, including fuel storage, quality control and supply of fuel to aircraft while the delivery of fuel to the airport bases is managed by the fuel suppliers themselves (BGS, Naftelf and RSS Motors).

In relation to the introduction of SAF in the second half of 2025, AB Orlen Lietuva plans to start blending SAF with conventional JET A-1 fuel, transporting it by rail to refueling bases as JET A-1 fuel. The Lithuanian Transport Safety Administration is the institution that authorizes the regulation of SAF and currently does not provide penalties for SAF-related violations.

The energy framework is defined by the National Energy Independence Strategy (NEIS), and the National Energy and Climate Action Plan 2021-2030. The NEIS is a comprehensive policy document delineates Lithuania's vision for achieving energy independence and sustainability by 2050. The NEIS sets forth specific targets, including increasing the share of renewable energy sources (RES) in total final energy consumption to 45% by 2030, 80% by 2040, and achieving full

energy independence with 100% domestic energy production by 2050, of which 80% will be derived from renewables.

The National Energy and Climate Action Plan 2021-2030 is a legislation framework related to tackling climate change. Within it are all the information and standards to be achieved by the year 2030 in Lithuania, both in the sphere of implementation of efficient energy solutions and in the sphere of diffusion in the use of SAF in the aviation sector. More specifically, the **National Energy and Climate Action Plan** describes the **obligation of 5% of SAF usage by 2030**, although this does not allow to fully achieve the goal set by the ReFuelEU regulation.

The main targets set by Lithuanian legislation are the following.

- **Implementation of sustainable aviation fuel supply infrastructure**. This might allow easing the achievement of the adoption of minimum SAF fraction in the fuel mixture by 2030, considering also that by today the aviation fuel supply and distribution process is not operated by the Vilnius Airport.
- **Upgrading of airport infrastructure** with the provision of six suitable spaces to serve new sustainable aircraft by 2030. In addition, new equipment is envisioned to be acquired and be prepared to receive electric and hydrogen-powered aircraft.
- **Achieve Net Zero by 2030** in terms of Scope 1,2 and 3 CO_2 emissions.

From the airport's perspective, several critical issues have been identified in the implementation of the Action Plan, in particular for SAF integration. These challenges are primarily logistical, since the fuel bases are rented out and fuel supply is performed not by the airport.

The Lithuanian Airport company controlling VNO, LTOU, emphasises that the regulation is not particularly clear on how to define the concrete measures that must be implemented to implement the action plan and the exact compliance standards that must be met.

1.2.4 Planned new Warsaw Airport (CPK)

The updated Polish National Energy and Climate Plan (NECP), published in October 2024, outlines key objectives for 2030, including a nearly 7% reduction in greenhouse gas emissions in non-ETS sectors compared to 2005 levels. This target aims to lower emissions from 394 tons of CO_2 in 2019 to a maximum of 377 tons by 2030. Additionally, the plan targets a near 23% share of Renewable Energy Sources (RES) in gross final energy consumption, a goal that could be more attainable with additional EU funding, especially for energy transition projects while the transport sector is expected to contribute a 14% share of RES[8].

Category	Target Year	Objective	Reference Year/ Baseline
Non-ETS GHG Emissions	2030	-7% reduction in emissions	2005
Non-ETS GHG Emissions	2030	Maximum 377 $MtCO_2$	2019 (394 $MtCO_2$)
Renewable Energy Share (RES) - Total	2030	~23% of gross final energy consumption	-

Renewable Energy Share (RES) - Transport	2030	14% share in transport sector	-

Table 5 - Poland ETS targets

The framework for the deployment of sustainable fuels and related infrastructure was introduced by directly applicable regulations to maintain the SAF levels of the Aviation Fuels Regulation, with possible exemptions provided.

- As for the development of infrastructure for sustainable fuels resulting from the **AFIR regulation** (Alternative Fuels Infrastructure Regulation), space for it has been provided at the CPK Airport. The exact quantities for electric car chargers on the road depend on national plans for AFIR and the domestic implementation of subsequent modifications to the number of chargers resulting from the EPBD directive (Energy Performance of Buildings Directive).
- The **EPBD**, which will be transposed into national law in 2026, also sets out ways to achieve zero-emission buildings (sustainable energy supply), including those intended for public use.

Specific domestic laws from the query are absent yet, however general tax reliefs are in place e.g. the R&D relief supporting conceptual work on a new product, in addition, also the Prototype relief supporting the transfer of the idea into the language of practice and production, or another relief supporting innovative employees, facilitating competition for specialists with key skills and competences.

Apart from the regulations resulting from the above-mentioned EU regulations, there are no other than possible self-regulations or business certifications such as IATA Environmental Assessment (IEnvA). It is a voluntary certification program developed by IATA to independently assess the commitment of aviation stakeholders such as airlines, airports, cargo handling facilities, freight forwarders, MROs, caterers, and ramp handlers, to continuously improve their environmental and sustainability performance (the ISO 14001 environmental management system standard based).

1.3 Key Conclusions

To summarize the contents of this chapter, it is clear that, at present, the implementation of SAFs (Sustainable Aviation Fuels) in Europe is largely left to the discretion of individual Member States and competent authorities. These, in turn, delegate significant autonomy to airport operators, third-party stakeholders, and energy management teams, allowing for tailored, case-by-case approaches.

However, the targets defined under the ReFuelEU regulation are generally being adopted by Member States without being translated into detailed local decarbonization strategy. Instead, most countries prefer to adhere to the broader guidelines established at the European level.

From an operational perspective, existing airport infrastructure designed for conventional Jet A-1 fuel, is generally capable of handling SAF blended without requiring substantial

modifications. SAF is a “drop-in” fuel, fully compatible with current airport facilities and aircraft, thus eliminating the need for additional infrastructure to support its deployment.

Moreover, SAF can be blended with conventional jet fuel within the limits defined by ASTM D1655 and ASTM D7566 standards, ensuring compatibility with current storage, distribution, and refuelling systems.

These factors suggest that the transition to SAF is technically and operationally feasible with minimal disruption. Existing infrastructure and regulatory frameworks provide a solid foundation for SAF adoption, supporting its potential to drive effective and efficient decarbonization of the aviation sector.

Vilnius Airport has opted for a more cautious approach by setting its own internal guidelines and targets. While this strategy may help achieve realistic national goals, it could fall short of the broader ambitions outlined by the EU. This regulatory gap must be addressed, as aligning SAF implementation with the minimum thresholds set at the European level is essential to ensuring that national efforts contribute meaningfully to the overall decarbonization of the aviation sector.

2 Transport System

The transport system, as anticipated, is a key element of the airport system and contributes significantly in terms of its impact on emissions. In this chapter, an overview of the airport's current transport system will be described, followed by a description of the main initiatives for its development and improvement, along with their objectives.

2.1 Overview of the existing transport system

What will be discussed below is the situation at the state of art of mobility inside and outside airports. The preferential ways in which passengers and employees of airport entities typically decide to travel to the airport will be illustrated, together with the means used internally for people transport and ground handling operations – whether under the jurisdiction of the airport or owned by third parties.

2.1.1 Copenhagen Airport (CPH)

The airport is connected to its surroundings mainly by the Metro line, regional trains, and the 5C bus. It also has a direct connection to Sweden via the Oeresund train. Typically, the place is also reached by private cars and cabs.

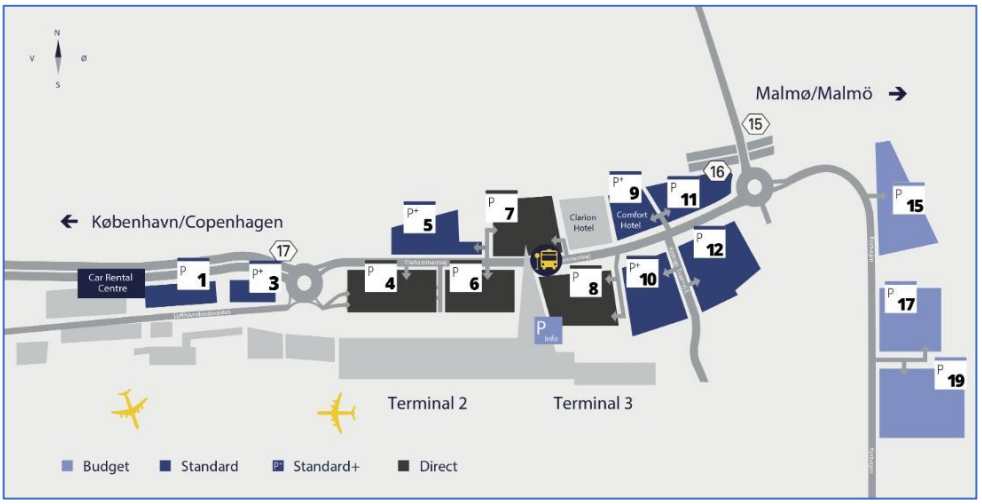

Figure 2 - CPH buses platform[9]

Of the transportation methods just mentioned, the metro, bus and train are most advantageous in terms of convenience as they would provide direct access to the terminals.

Public transportation, with more than **60% of people traveling by train**, **metro**, or **bus**, is therefore the most used way to reach the airport. The high percentage of people traveling by public transportation is a result of Denmark's well-connected train and metro system. The focus of CPH airport planning has been to ensure that connecting train and metro stations are located very close to the terminals. This provides a convenient bridge between the airport and the stations, making it easy to take public transportation to the airport.

Copenhagen Airports owns and operates a fleet of more than 650 motorized vehicles and equipment, many of which are highly specialized and all of which perform important tasks in

daily operations. Copenhagen Airport is also the largest cab station in Denmark, with about 6,000 cab rides to and from the airport being low-emissions vehicles in 2023. Since 2019, the airport's Taxi Management System has given priority to hybrid and battery electric taxis, shortening their wait time by up to 25 minutes. This incentive scheme has succeeded in making Copenhagen Airport more attractive to low and zero emissions taxis, with approximately 64% of taxis traveling to and from the airport being low-emissions vehicles in 2023.

Hence, road transport accounts for a significant part of the Airport's emissions of pollutants due to surface transportation to and from the airport. For this reason, electric vehicles play an essential role in decarbonizing this segment of the value chain. To facilitate the transition to electric vehicles, more than 400 charging points in the parking lots have been installed. The infrastructure has been revamped and developed through a partnership between Copenhagen Airports and EWII (a Danish energy group). EWII owns and operates the charging infrastructure, while Copenhagen Airports determines the number and location of charging points.

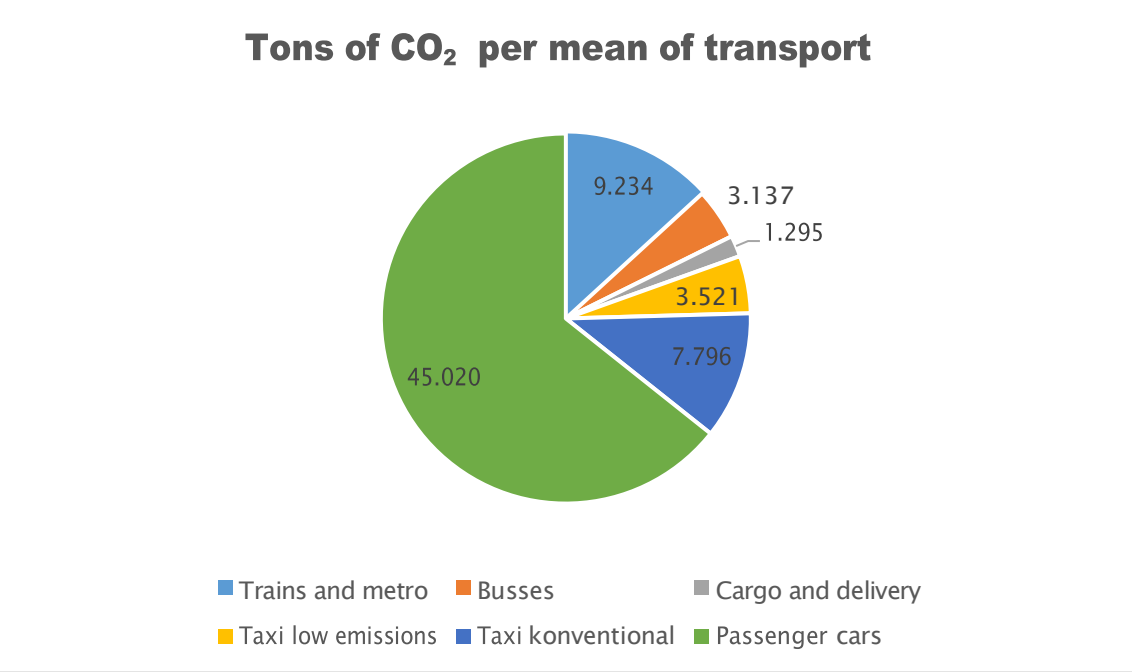

Figure 3 - Total CO_2 emissions divided per means of transport – CPH Net Zero Plan 2050[10]

2.1.2 **Fiumicino Airport (FCO)**

The airport transport system at FCO features a railway station served by the dedicated Leonardo Express line, which provides direct connection to Termini Station, as well as the regional FR1 line. Additionally, some high-speed train lines make dedicated stops at FCO, allowing it to be well-connected to the rest of the country with minor train exchanges.

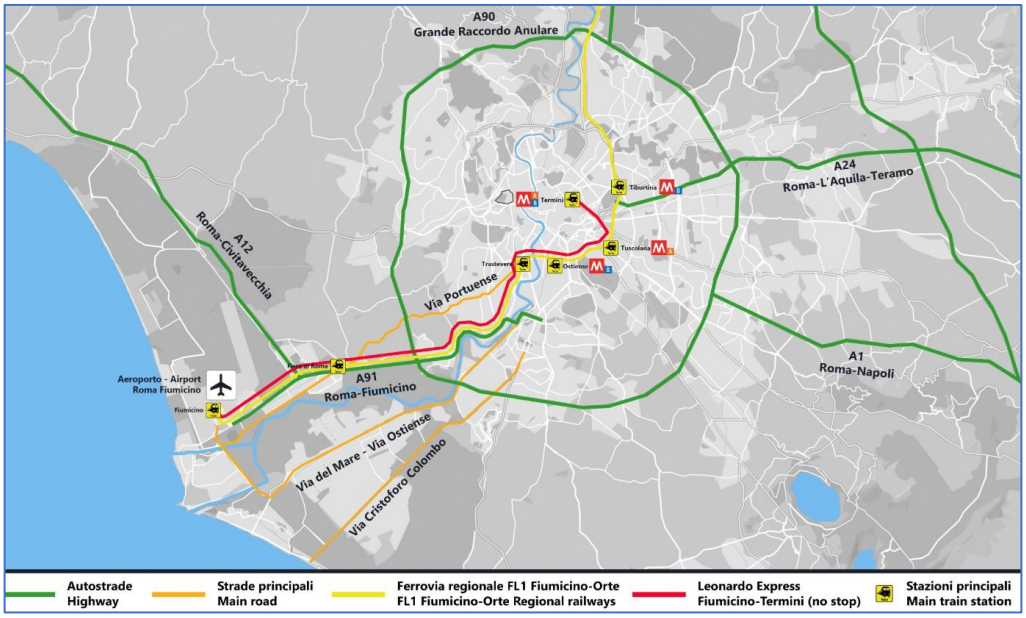

Figure 4 - FCO Transport System

Moreover, the FCO Airport hosts a dedicated bus station within the premises, offering regional and interregional bus services. Taxis, chauffeured vehicles (NCC), and a designated area for shared vehicles are also available. There are currently also nighttime travelling options allowing passengers to move to and from the airport. As regard buses, it is possible to choose among SIT Bus Shuttle, T.A.M. Bus, Terravision and Cotral coaches. It is also possible to call night-shift cabs and dispose of three different car sharing options that are E+ Drivalia, Enjoy and Sharenow.

The figure shows the percentage of passengers according to the means of transport chosen to reach Fiumicino airport.

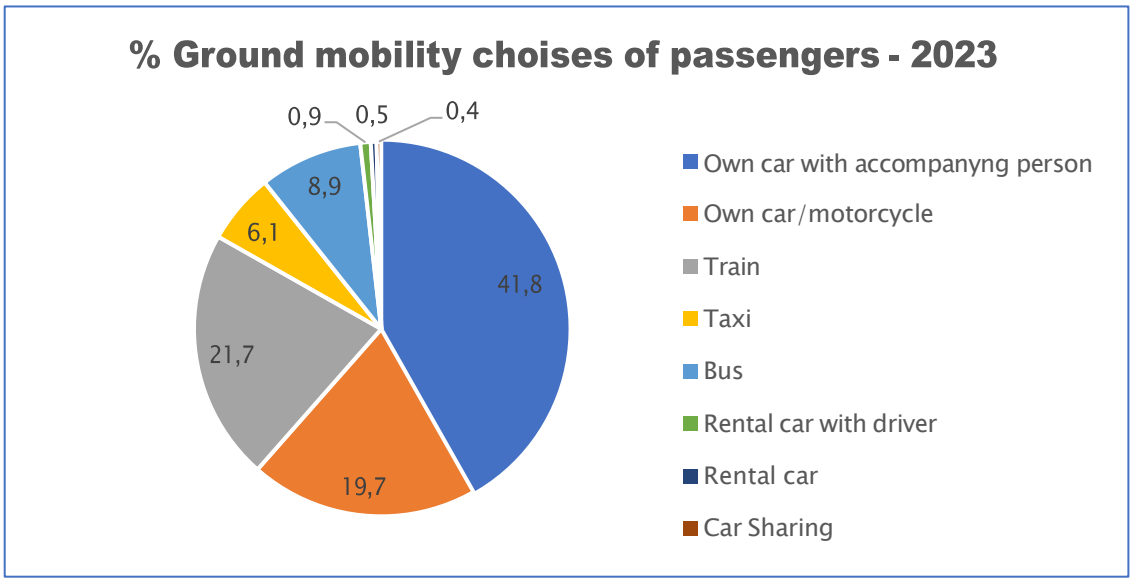

Figure 5 – Percentage of ground mobility choices of passengers, divided by mean of transport. Source: AIR (Annual Integrative Report), ADR

Thanks to the partnership between Trenitalia, Aeroporti di Roma (ADR), and ITA Airways, which are committed to innovation and environmental sustainability, passengers can purchase a combined ticket for a Freccia train (also connected with the Leonardo Express service) and an ITA Airways flight departing from Fiumicino Airport. Tickets are available through authorized agencies and ITA Airways' digital channels. Upon arriving at Fiumicino Airport via Trenitalia trains, passengers can take advantage of the new experimental check-in service, allowing them to drop off the luggage directly at the Fiumicino Airport railway station at a dedicated counter. The luggage will then be available for collection at the final destination of the ITA Airways-operated flight. Starting in May 2024, a new FCO Connect point is available at Termini Station.

In 2022 ADR, SAVE, Aéroports de la Côte d'Azur and Aeroporto Marconi di Bologna established the company UrbanV, active in the Advanced Air Mobility sector and, in particular, in the construction and management of the infrastructures used by operators for landing and take-off operations – the "Vertiport". It is a system that will allow people autonomous travelling between airport and city center via flying electrified drones. To develop this innovative solution, UrbanV continued to study vertical networks in the areas of Rome, Venice, Cote d'Azur and Bologna together with its founding partners. From a regulatory point of view, UrbanV continues to collaborate with ENAC and ENAV in drafting the first Italian regulation for Advanced Air Mobility. Starting operations will be between a vertiport at Fiumicino airport and one in the city center, allowing in the future FCO Airport to be connected to the centre of Rome via the dedicated drone service[11].

Figure 6 - Fiumicino Airport's Vertiport - IAR 2023

2.1.3 **Vilnius Airport (VNO)**

Vilnius Airport is well connected to the city centre both by a dedicated train line and frequent buses and several trains regularly depart from Vilnius railway station to the airport. In the immediate vicinity of the airport passenger terminal, there is a railway station, a staircase and an

elevator for passengers, as well as lighting and a video surveillance system to ensure the safety of travellers. A path with a covered tunnel, which lights up in the dark, connects the railway stop to the airport terminal.

On the other hand, the "Airport Express" bus route is the most convenient connection between Vilnius Airport and Vilnius Bus Station, from where you can travel to any city in Lithuania or a European country. These buses run frequently on a daily basis to and from VNO Airport. The bus stop is located next to the new departures' terminal. There are four buses to/from Vilnius Airport every 20–30 minutes, with one bus every 10 minutes. The night bus operates every evening from 10:30 PM to 5:30 AM, running every 30 minutes.

Furthermore, Car-sharing services such as Bolt and Uber, as well as private cars, are commonly used for transportation.

The average time to reach the airport from city centre is about 15 minutes in normal traffic, the connection will be improved with a new Railbaltica connection (it's planned that the station will be under the terminal, now you must take a 5 min walk to get to the railway station).

Below are reported the percentages of use of the different transportation means, according to the airport data:

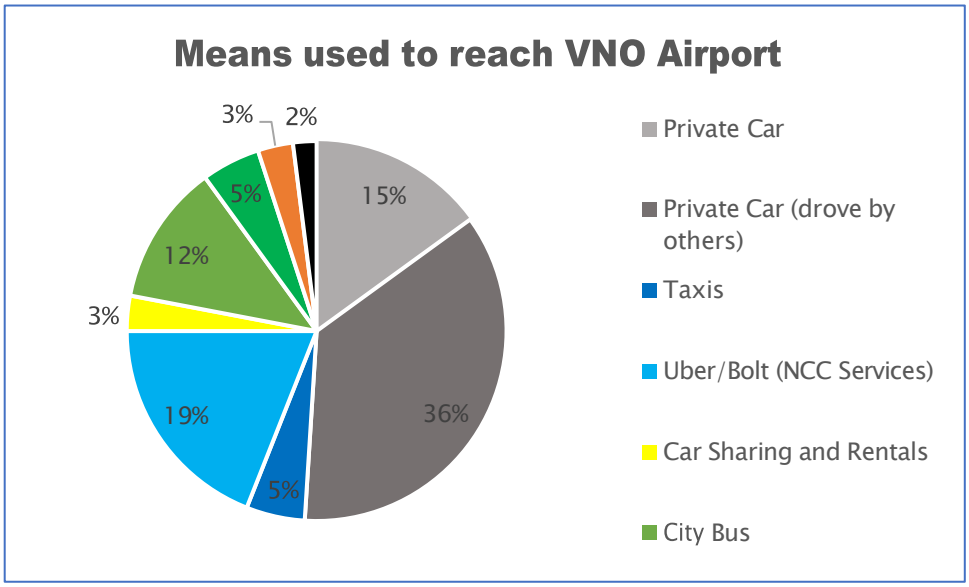

Figure 7 - Survey result - Means used to reach VNO airport

2.1.4 **Planned new Warsaw Airport (CPK)**

The A2 highway and rail lines are the main connections between CPK Warsaw Airport and downtown Warsaw and Łódź. There also are coaches and urban buses to link Warsaw to CPK, and a seamless pedestrian connection between terminal, bus station and railway station.

In addition, a trunk road is planned to connect the suburban area of the capital to the airport, along with the regional train line. Moreover, an additional connection is under construction to make it possible to reach Modlin airport via Warsaw from CPK by means of a dedicated shuttle

train. No metro line is planned, as CPK is located 40 km away from Warsaw: the metro is mainly used to move people quickly across Warsaw for shorter distances.

Hence, the most used means used to reach CPK are private cars and cabs, tnc and car sharing. In addition, parking shuttles, crew shuttles, urban buses, coaches and airport express trains, other fast trains, regional train are used as well. The graphs below report the share of transportation means used by passengers and employees to reach the Airport during the average opening day. The first graph is related to what CPK Airport expects would be the overall situation after the mobility improvements will be carried out. The others are related to nowadays, showing respectively the transportation choices made daily by passengers and employees.

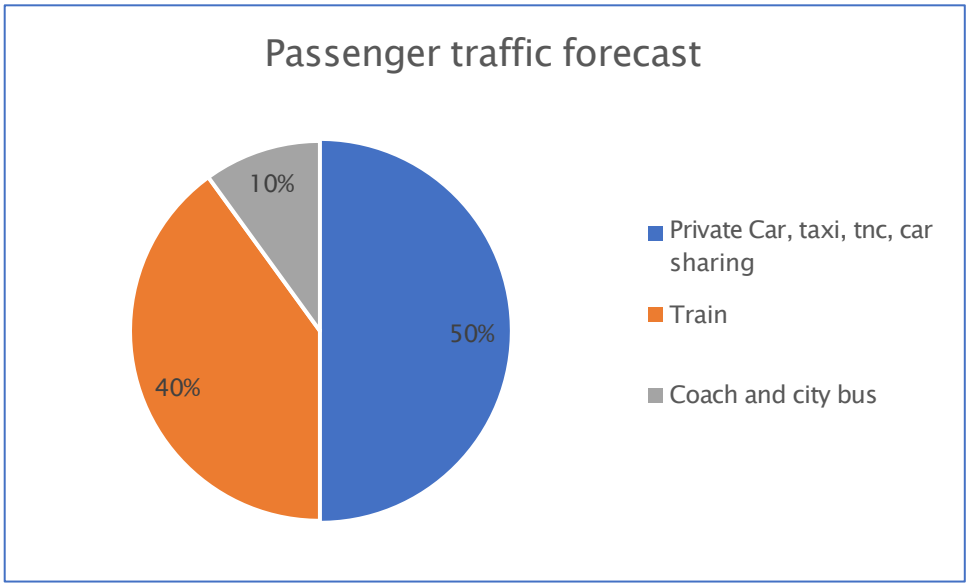

Figure 8 - Survey result - Passenger traffic forecast.

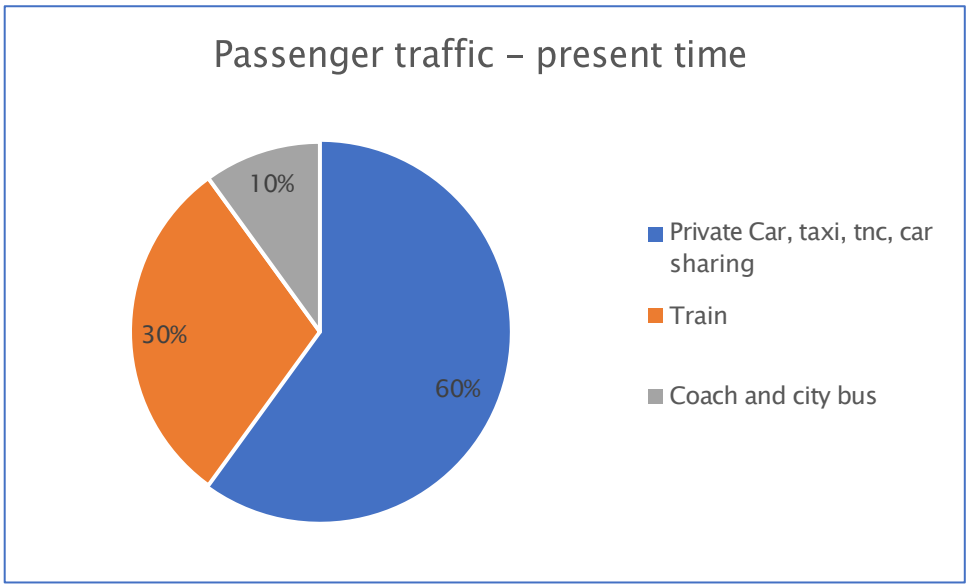

Figure 9 - Survey result - Passenger traffic present time situation.

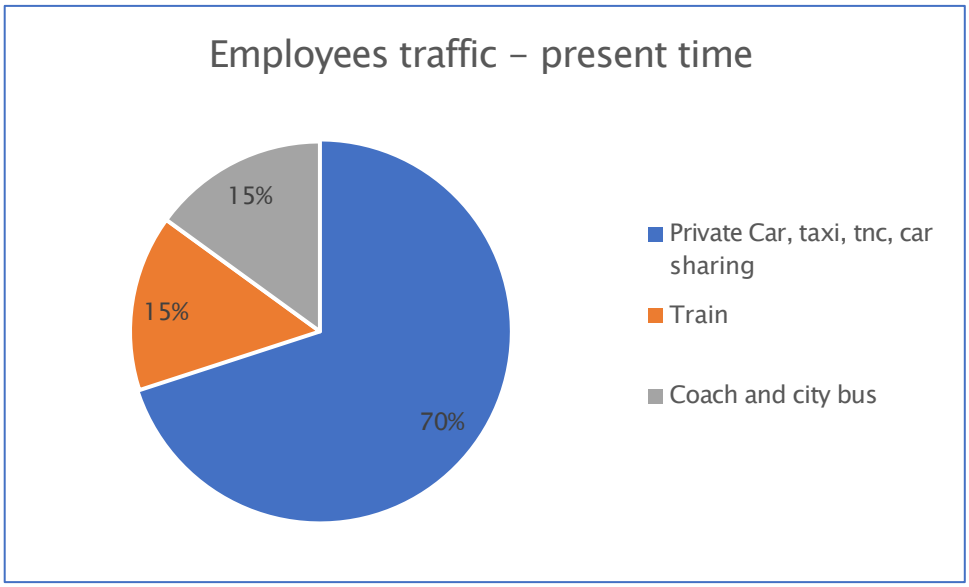

Figure 10 - Survey result - Employees' traffic present time situation.

Estimated time of arrival to the Airport by train is about 20 minutes and about 45 minutes by car without traffic congestion. The main effort of CPK is to increase the share of rail for passenger traffic to reduce the use of private cars, as it can be seen by the forecast diagram above.

2.2 Transport system development strategy and targets

This section contains the strategies and targets adopted by the various airports to improve and make the transport system more efficient, in cooperation with local realities.

2.2.1 **Copenhagen Airport (CPH)**

In the Copenhagen area, several initiatives involving transport companies are underway to optimise connections and achieve the jointly agreed climate targets.

About Movia, the company that operates buses in the Copenhagen area, a goal of abandoning fossil fuels for all buses by 2030 has been set. The metro company has an ambition to minimize the overall climate footprint associated with new mobility projects, and specifically, subsite the goal of halving the carbon footprint from the construction of new metro projects, compared to current lines.

On the other hand, DSB is the company that runs the regional trains and has set four main goals for decarbonization:

1) Reduction of the climate impact from operations by 98% by 2030

2) Reduction in the overall energy consumption by 50 % by 2030

3) Total abatement of particulate emission from trains' engines by 2030

4) At least 90% of the waste must be reused by 2030. And by 2050 they will be net zero across all activities.

In addition to the ongoing efforts, airside operations partners are formulating and implementing fleet decarbonization plans.

CPH is making a concerted effort to enable commuting with a smaller carbon footprint and to ensuring that less carbon intensive transport solutions are available and incentivised.

In 2023, Copenhagen Airport became the first airport in Scandinavia to be certified as a Bicycle Friendly Workplace. The infrastructure with trains and metro makes it easy to bring a bicycle, and additionally there are good cycle paths to and around the site. CPH achieved a gold certification for the implementation of new initiatives and further improved their facilities.

In addition to promoting cycling, CPH also incentivise employees to commute by public transport by offering discounts on public transport through the commercial agreement offered by DSB, the Danish train services.

2.2.2 **Fiumicino Airport (FCO)**

FCO's strategy to improve the transport system focuses mainly on the electrification of the fleet. In 2024, he took part in the SAVES project, which aims, among other objectives, to explore the introduction of hydrogen in airport ground transportation.

The SAVES project, launched by ENAC and ENEA, focused on integrating new sustainable energy carriers (including hydrogen) into the airport logistics chain at Rome Fiumicino and Milan Malpensa airports. These two airports were selected by a dedicated ENEA-ENAC Commission as part of a national call for proposals aimed at identifying one or more case studies of particular relevance at the national level.

One of the objectives of the project, through the case studies on the introduction of energy carriers such as SAF and hydrogen, was to support ENAC and ENEA in drafting national guidelines that could serve as a reference for future airport decarbonization projects.

The project involved multiple stakeholders, including fuel and energy suppliers, University, Airways, handlers and many others.

ADR has conducted a pre-feasibility study for the installation of a Hydrogen Refueling Station (HRS) within the Fiumicino airport premises, aimed at serving both airport ground support equipment (GSE) and the vehicle fleet of operators circulating around the airport.

To achieve this, the first step was to assess the potential hydrogen demand by conducting an exploratory survey and organizing meetings with project partners. This process allowed for mapping the vehicle fleet, fuel consumption, travel routes, and the remaining useful life of the vehicles[12].

2.2.3 **Vilnius Airport (VNO)**

Vilnius Airport is developing charging stations for electric vehicles in the new short term parking stations and is planning to install more of it for future expansion needs, to incentivize the adoption of BEV and Plug-in HEV by passengers and employees. Up to now, together with the new departure terminal, the central parking area in front of the VNO terminals was reconstructed. The project included 5 double (10 charging points in total) electric vehicle charging stations, but

during the reconstruction, cables and power were brought in to allow for a total of 17 double (34 charging points in total) electric vehicle charging stations. They will be installed in the future according to demand.

Other main initiatives to push towards the adoption of green mobility solutions are undertaken in collaboration with Railbaltica, the company owning rail lines in Poland, Lithuania, Latvia, and Estonia. In detail, it will provide new short- and long-term parking infrastructure with charging stations for battery electric vehicles.

Moreover, the railway system will experience the development of new routes, as shown in the figure below, to connect Vilnius airport with the Vilnius International Passenger Station.

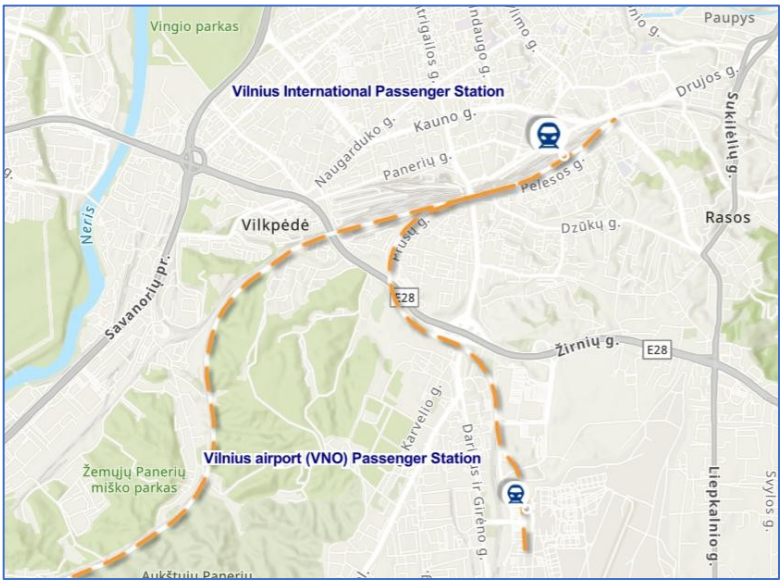

Figure 11 - Railbaltica railway project[13]

Railbaltica is also planning, together with the municipality of Vilnius, to purchase electric and hydrogen fuel cell buses to decarbonize the current fleet. The hydrogen refuelling station will be provided by Vilnius central heating company, VŠT. The project involves installing a 3 MW electrolyzer to produce green hydrogen using electricity to power 16 fuel cell buses. These will replace diesel buses, saving about 1,414 tons of CO_2 equivalent per year – the equivalent of about 1.7 million kilometers per bus. Also planned is the installation of a 1.7-ton hydrogen storage facility and a public access fueling station in Justiniškės. This will be located about 4-5 km (both in terms of linear and route distance) from the VNO airport. The project deadline is the second quarter of the year 2026.

2.2.4 **Planned new Warsaw Airport (CPK)**

Transport infrastructure is planned and designed in line with sustainability strategy in CPK. The traffic congestion is taken into consideration, and the capacity of whole system is at level allowing to have LOS (Level of Service) between C and D, to enhance the sustainability.

New Warsaw CPK Airport does not set specific targets for decarbonization and the promotion of sustainable practices, but it is committed to ensuring the highest possible utilization rate for

public transportation, including planning initiatives that encourage the propagation of electric vehicles and the wide-ranging exploitation of car-sharing initiatives. Regarding bus mobility, the installation of fast chargers is planned alongside the deployment of electric-powered buses, also guaranteeing frequent and rapid power supply to existing electric regional buses. In addition, the use of electric shuttle buses for parking areas is planned, together with increased availability of charging infrastructure for BEVs.

As regards the overall carbon footprint evaluation, CPK Airport is planning the gathering of the necessary data on vehicles movements across the internal parking and internal roads network. The method that is used succeeds in making an acceptable estimate for the carbon footprint related to an individual passenger on the opening day. Real-time traffic data and official emission factors are the basis for the method, which involves following four steps.

The first one is **Data Collection**: the airport is deploying an Intelligent Transportation System (ITS), which includes traffic counters and classification at main airport road entries, ITS infrastructure integration into the airport road network and the nearby motorway A2, parking system data and traffic control tools for demand management and fleet data from external partners, including taxi, TNC, and bus operators.

The next step is the **Emission Calculation Approach**. The CO_2 footprint will be calculated using official emission factors mainly from the Główny Urząd Statystyczny (Statisics Poland), ensuring consistency with national statistics. The methodology follows a distance-based approach, where emissions are estimated as:

$$CO_2e = \sum_i (\text{Vehicle Count}_i \times \text{Average Distance}_i \times \text{Emission Factor}_i)$$

where:

- Vehicle Count: The number of vehicles accessing the airport by type (e.g., private cars, taxis, buses).
- Average Distance: Estimated based on traffic data and typical trip lengths in the airport's catchment area.
- Emission Factor: Standard CO_2 emissions per kilometre per vehicle type, sourced from GUS.

The future airport is committed to monitoring and reducing CO_2 emissions from landside road transport. Hence, the following step is ensuring the **airport's approach to low-emission transport**, mainly by promoting the use of low- and zero-emission vehicle fleets and by encouraging public transport use, carpooling and rides sharing among passengers. However, there are no plans to introduce additional specific carbon footprint KPIs beyond the general monitoring framework.

The last step is the **consideration for Electric Vehicle Charging Infrastructure**. Due to ongoing legislative developments, a clear methodology for estimating the demand for battery

electric vehicle (BEV) and hybrid electric vehicle (HEV) chargers is not yet available. However, based on expert assessments:

- The functions of parking and charging stations should remain separate
- Despite the trend of combining these functions, the airport plans to provide the minimum required charging infrastructure
- The airport is considering requesting an exemption for transport hubs (e.g., railway stations and airports) so that the number of chargers is scaled based on staff numbers rather than passenger or passengers parking capacity.

CPK Airport intends to implement policies that incentivize minimizing the environmental impact of individual passengers by reducing their carbon footprint. First of all, shared car travel is promoted as the main solution to decarbonize, since to today, private car travel is still the most popular choice for passengers to reach the airport.

In addition, CPK currently incentivizes the decarbonization of passenger transportation by designing infrastructure and proposing the presence of high-density rail lines with fixed and regular schedules. This initiative aims to discourage the use of road transportation, which is inconvenient both because of ease of congestion on the A2 motorway in the direction from Warsaw and frequent traffic congestion within the city itself, which make travel longer and more unpredictable, as well as highly polluting. In addition, to encourage the use of the train to reach the airport, agreements are planned with railroad operators regarding the possibility of integrating the travel fare within the city ticket or one-time city ticket system. Eventually, any passenger willing to travel across the region could commute by regional trains such as KM or SKM rather than PKP trains.

Furthermore, CPK is going to engage local governments for cooperation for organizing local public transport jointly in cooperation. For example, CPK considers awarding additional green fleet points in procurements for any transportation service that requires a fleet of cars, such as local parking transportation, taxi plaza corporations, etc.). On the other hand, environmentally friendly transportation initiatives cannot be promoted by the CPK airport as regards long-term parking users because of competition from “wild parking” in the surrounding area.

At this point of development CPK assumes the following incentives for airport workers:

- Discounts/dotations for rail transportation
- Discounts/dotations for bus transportation
- Program of free meal for carpooling and bikers
- Discounts for parking places for non-emissions cars
- Regular cars with one driver with regular payment for place.

CPK Airport does not currently have any business model to support the decarbonization and incentive initiatives of green solutions proposed above. However, there have already been precedents in promoting the use of alternative means of transportation to private cars and car sharing, and in each of those many cases they have worked without having a detailed economic breakdown.

2.3 Key Conclusions

An analysis of the transport systems serving the partner airports reveals that while rail and bus services provide the primary public connections to city centers, the majority of passengers still prefer private car.

It will be essential to implement targeted initiatives that promote more sustainable mobility choices. One key area of focus should be the expansion of electric vehicle (EV) infrastructure, such as the widespread installation of EV charging stations within airport parking areas and surrounding transit hubs. This would not only incentivize the use of electric cars by improving convenience and accessibility but also support broader regional and national decarbonization goals.

Moreover, promoting shared mobility solutions, such as carpooling, car-sharing, and micro-mobility options like e-scooters and bike-sharing, could contribute to reducing the environmental footprint of airport access.

3 Initiatives to Promote Community Development

This chapter outlines and provides a detailed analysis of the key initiatives designed to support and engage the community. It explores the objectives, implementation strategies, and expected impacts of these initiatives, highlighting their role in fostering social, economic, and environmental benefits.

3.1 Initiatives and projects

Several concrete initiatives have been undertaken to achieve the a forementioned objectives. The projects mainly involve social interventions benefiting the community, mostly in collaboration with local public administrations. Examples include naturalistic installations, the establishment of parks, bike paths, and green areas, as well as the implementation of practices to promote the circular economy. On the other hand, internal interventions are carried out to reduce the carbon footprint, starting with the consumption related to ventilation, air conditioning, and air treatment systems in indoor environments. These include revamping existing thermal power plants, replacing heat generators with heat pumps, replacing lighting systems with LED devices, and other HVAC-related interventions. Additionally, infrastructure is being set up to support the electrification of maneuvering vehicles on the runways and the movement of people and goods within the perimeter and in parking areas.

3.1.1 **Copenhagen Airport (CPH)**

In cooperation with local authorities, CPH Airport is exploring the possibility of replacing the site's largest heat generator by supplying thermal power via district heating system in the western area of Copenhagen Airport. Furthermore, CPH is looking into electric heating pumps as an addition, to transition away from using natural gas.

Moreover, CPH has an established **"pollution program**", under the sustainability strategy aiming to acknowledge the environmental impact and pollution generation caused by daily airport operations, taking into account air quality, water resources, soil and the propagation of noise into the surrounding environment. More specifically, the airport is committed to reducing the air pollution, minimizing noise affecting the local area, and protecting soil and water through pollutant containment, water reuse, and the ongoing development of technical solutions for collecting and treating water from various airport activities. Current mitigation efforts include but not limited to:

- 12 permanent monitoring stations to measure noise levels in different points of the airport's perimeter
- 3 monitoring stations to measure particle levels in air
- 4 water treatment plants to prevent PFAS from spreading.

In 2008, a decision was made to completely eliminate the use of fire-fighting foams containing PFAS, although those without PFOS/PFOA remained legal until 2024. The previous use of these substances caused soil contamination in the training areas and the spread of pollutants into the airport's surface water system. Since 2010, Copenhagen Airports has implemented investigations and containment measures to protect water resources and surrounding ecosystems,

installing four water treatment plants and actively cooperating with the authorities to address the problem.

Additionally, under the sustainability strategy, the **Nature programme** in this regard was approved in 2024 and will be further developed during the year 2025. The focus on nature is a new initiative for Copenhagen Airports, which is still in the early stages of the work in this programme, which encompasses considerations of the natural surroundings and an understanding of the importance of biodiversity and ecosystem functions. Through the Nature programme, CPH intends to address impacts on nature, both directly and through the value chain, to understand their resilience towards and for nature. This is reflected within various dedicated programme areas.

The Onsite programme area considers impacts and opportunities within own premises, which, as an operating airport, imposes certain restrictions and responsibilities. Ensuring flight safety remains our highest priority. This necessitates specific safety measures that, at times, require us to manage nature and biodiversity within the airports' secure areas.

Within the focus on their value chain and how it intersects with nature, the ambition is to better understand impacts and dependencies on nature, as well as to assess associated risks and opportunities throughout our value chain.

In addition to the Nature programme, CPH intends to undertake the **Transition to circularity programme**, to develop circular economy policies to reduce the rate of consumption of our planet's finite resources. This sets the target of a "circular airport" by 2050, thus plans are being developed to ensure achieving the goal. The target for CPH is to be a circular airport by 2050 and they are making effort for developing plans to ensure we reach our target. The general goals and principles for how CPH Airport intends to work with circularity have been defined and now two-year action plans are being developed and implemented for each of four workstreams (nature, circularity, emissions, efficiency). One of the main targets at 2030 is to being a recycling rate of 60% of total waste disposal.

Sustainability is also promoted trough four main workstream: procurement, shopping center, construction and waste management. The CPH endeavours to avoid or postpone the purchase of products and materials by using existing resources, reusing and sharing goods already purchased, and focusing on purchasing products with eco-labels or minimal environmental impact wherever possible. The airport is aimed to enable tenants to become circular units, increasing cooperation with partners and supporting the increase of solutions minimising its impact on the environment. CPH is also working towards avoiding unnecessary new construction and components, as well as designing for longevity, adaptability, and disassembly. The airport will analyse waste streams and related work processes to optimize resource flows, extending material use and minimizing waste generation. Recycling will be maximized, and efforts will focus on reducing landfill disposal by ensuring a user-friendly waste management system.

Related to Climate Adoption, Copenhagen Airport is as a critical piece of Danish infrastructure especially for is location in proximity to the coast. In line with the strategy focus on climate adaption, in the period of 2022-2024 CPH has contributed to a preliminary study of a

comprehensive storm surge protection plan for the capital of Copenhagen. The Ministry of Transport has been the overall coordinator of the preliminary study.

In addition to the previously mentioned programs, Copenhagen Airport reinforces its commitment to the community with the launch of a sponsorship program in 2023, aimed at supporting residents and organizations in Amager. Through this initiative, CPH provides funding for local projects and activities that promote community engagement, sports, and health, while also offering support to organizations and volunteers.[14].

3.1.2 **Fiumicino Airport (FCO)**

Fiumicino airport has several environmental initiatives, including noise monitoring, controlling local pollutant emissions, as well as projects dedicated to circular economy and water management, and has also decided to commit to generating social welfare with different projects. Here below the most recent ones.

"Pedalaria" project consists of an investment of 1.8 million euros, regarding a new cycling route connecting Leonardo da Vinci Airport with the city of Fiumicino. This initiative promotes eco-friendly transportation alternatives, encouraging both travellers and local residents to opt for greener mobility solutions. The new pedestrian and bicycle path starts at Rome's main airport and extends for 3.5 kilometres, connecting to the existing bicycle path in the airport district along Lake Trajan Avenue[15].

Another project for the community is the **realization of the "Newton Room"**, which consists of a first-of-its-kind innovative space into which are offered STEM (Science, Technology, Engineering, and Mathematics) lectures related to the aviation industry for middle and high school students aged 13 to 16 from local schools and the wider regional area. The Newton Room is located at the Arrivals area of Leonardo da Vinci Airport in Fiumicino and has been sponsored by the owner of FCO and Ciampino airports, ADR, in collaboration with U.S. aerospace company Boeing and the Norwegian non-profit organization First Scandinavia.

Further commitment by FCO Airport is given to biodiversity and CO_2 compensation project that is, **tree planting at "Tommaso Forti" park** in the municipality of Fiumicino. The park is located outside the airport grounds, giving the project an added social value as a contribution by ADR to the well-being of the local community. To actively contribute to the enhancement of the local environment, ADR and Lagardère Travel Retail Italia, the company managing various duty-free stores at Rome's airports, have invested in reforestation, tree planting, and environmental restoration projects. This initiative is part of a broader sustainability program launched in 2021, in which both companies committed to progressively replacing plastic bags sold in some Lagardère Travel Retail stores at the two airports with paper or reusable alternatives. The Tommaso Forti Park project, completed in March 2024, involved the planting of tall trees along the perimeter of the park, which borders high-traffic roads, creating a green barrier to reduce fine particulate pollution and noise levels. Within the park, the creation of tree clusters will help mitigate extreme summer temperatures, providing much-needed shade. In addition to tree planting, the project included targeted restoration efforts, such as landscape design improvements, preservation of the park's identity, and the creation of new functional spaces. The

initiative also involved the installation of ten picnic sets donated by ADR, enhancing the park's accessibility and improving the experience for residents and children who visit the area daily.

ADR has launched activities to implement interventions aimed at the conservation of entomological diversity, in particular of pollinating insects. The interventions will include the creation of scrub compositions in the green areas and the **Beehotels** dedicated to attracting pollinating insects. In addition to contributing to the conservation of biodiversity, these interventions aim to stimulate greater awareness and knowledge in citizens and airport personnel on the importance that these green interventions can play in the development of greater biodiversity.

3.1.3 **Vilnius Airport (VNO)**

There are mainly two initiatives planned to promote community development in Vilnius, particularly regarding sustainable mobility and energy efficiency for the capital city municipality.

Vilnius airport has implemented and is developing several community support initiatives. Here are listed the most valuable ones.

- Installation of electric vehicle charging stations.
- Replacement of mobile diesel-powered Ground Power Units (GPUs) into electric ones.
- Noise control: VNO has noise management plan that is renewed every 3-4 years, to comply with the Legislation of Noise, that also defines a protection zone limiting construction of residential buildings near airport. Four noise monitoring stations are installed in Vilnius to measure the noise impact by the airport.
  Main limitations apply for Medium and Heavy aircraft departing from RWY 01:
  - All-direction departures are prohibited
  - Departures must be conducted 24/7 according to the instrument routes published in the AIP – SIDs (Standard Instrument Departure)
  - The first turn point VI101 has been "shifted" approximately 2 km to the north, away from densely populated areas
  - Aircraft that cannot maintain the Standard Instrument Departure (SID) route are allowed to make a left turn only after the aircraft has passed waypoint VI101 and reached an altitude of 4000 feet above MSL, and a right turn only after reaching an altitude of 3000 feet above MSL.
- De-icing wastewater collection system and treatment plant (plant is still being tested). With that, potentially polluted wastewater is not introduced into the environment resulting in a positive contribution to the preservation of biodiversity
- Extension of taxiway to reduce aircraft taxing time from runways to stands, by VNO.

Currently the airport is in design stage of building larger solar plants reaching a total rated power of nearly 4.5 MW_e, together with the already existing smaller PV plant on the roof of the new terminal and on VIP terminal. The new plant does not have an energy-sharing configuration to date, but this could be a possible scenario in the future.

Now, the main focus is to ensure flight safety and reduce collisions with the number of wild animals and birds. Confirmed bird collisions on 1,000 flight reports are measured on a yearly basis to keep track of the environmental impact on local flying fauna and to prevent aircraft

accidents in the vicinity of the airport, both on the ground and in the sky. Thus, several countermeasures are implemented by Vilnius Airport, according to the regulative framework listed below:

- European Union regulation no. 1108/2009
- Annex 14 of the Convention of the International Civil Aviation Organization (ICAO)
- Airport service manual (DOC 9137 – AN/898)
- International Bird Strike Committee (IBSC) recommendations for airfields
- Airports Council International (ACI) Animal hazard at aerodromes management manager.

Hence, the main countermeasures are:

- Sound cannons for scaring birds, controlled by a remote control
- Bird alarm sound equipment
- Audio equipment for scaring birds and other animals on cars.

3.1.4 **Planned new Warsaw Airport (CPK)**

The Warsaw Airport will provide support to local communities through funding for projects related to education and training, science and innovation, social assistance and charity, social wellbeing development, public safety, environmental protection and nature conservation, health, culture, art and heritage, sports, tourism and recreation, as well as the development of roads and public transport. CPK will support the education sector with the aim of aligning its training offer with the future needs arising from the airport's operations.

In the next phases of development, CPK plans to implement a series of biodiversity initiatives to ensure environmental sustainability, considering the protection of the natural environment a fundamental objective for the airport. These various initiatives include the protection of valuable, rare, or protected natural habitats, as well as plant, fungal, and animal species identified during preliminary environmental surveys. A key priority for CPK is to preserve, as much as possible, existing wildlife migration routes and ecological corridors between valuable natural areas, in order to maintain genetic diversity within species populations and ensure the long-term conservation of local and regional biodiversity.

Objective	Target	KPI			
		Metrics	Development phase	1st year of operations	5th year of operations
5.2 Providing greenery within the airport	5.2.1 Establishment of biodiverse active green areas on the airport	% of all green areas on the airport	N/A	TBD	TBD

Table 6 - Biodiversity's KPI for CPK Airport

The reduction of airport noise is one of the main objectives for CPK. The relocation of operations from the current Chopin Airport, located within the city of Warsaw, will result in a significant decrease in the number of people exposed to excessive aircraft noise levels. Noise management will be closely linked to land-use planning, which will need to consider areas subject to high noise emissions. In these areas, it will be crucial to avoid the development of buildings

intended for noise-sensitive uses, in order to prevent land-use conflicts and ensure compliance with current noise pollution regulations.

To effectively reduce the impact of noise, a set of initiatives will be implemented, targeting flight operations, infrastructure, and equipment management. The planned measures include:

- Monitoring and recording the acoustic performance of flight operations, in order to identify and catalog the noisiest aircraft types.
- Introduction of economic incentives, such as differentiated landing fees, to encourage the use of quieter and less polluting aircraft.
- Adoption of operational procedures, such as the Quota Count system, to limit the number of high-noise operations.
- Application of, if necessary, restrictions on the loudest operations during nighttime hours to reduce disturbance to surrounding communities.
- Selection of facilities and technical devices based on their acoustic performance, prioritizing solutions with lower noise emissions
- Ensuring regular and proper maintenance of all technical equipment to avoid noise increases due to inefficiencies or mechanical malfunctions.

Objective	KPI	KPI indicator			
		Metrics	Development phase	1st year of operations	5th year of operations
4.6 Ensuring acoustic and vibration monitoring	4.6.1 Number of active noise measurement points	Total number	N/A	At least 12	Target to be set out after first year of operation

Table 7 - Noise measurement KPI's for CPK Airport

3.2 Key conclusion

The main initiatives implemented by airports for community development mainly concern the reduction of local pollution in the surrounding areas and noise pollution.

In addition, many initiatives are dedicated to the care and maintenance of the area's biodiversity, a crucial issue in terms of sustainability that cannot be neglected.

4 Examples of other airports

This section aims to share the experiences of some major airports located in Europe, United States and Asia in terms of main regulation and how it's applied from national to local context, definition of a sustainable transport system and different initiatives for the community development.

4.1 Local regulation

San Francisco (SFO)

California has introduced the California Low Carbon Fuel Standard (CA-LCFS), a measure designed to reduce greenhouse gas emissions in the transport sector. The policy framework applies a carbon intensity reduction system to assign a value to the carbon reduction generated by renewable fuels by calculating the benefits of SAF through a life-cycle assessment model compared to traditional jet fuel. The legislation was updated in 2019 to recognise SAF as a fuel eligible to generate credits, incentivising the production of SAF through trading with obligated parties under the CA-LCFS.

The LCFS program incentivizes the use and production of low-carbon fuels in California, reducing GHG emissions and dependence on petroleum in transportation. It measures the carbon intensity (CI) of fuels throughout their life cycle, considering both direct emissions and indirect effects. Fuels with a CI below the annual benchmark generate credits, while those above it generate deficits. Fuel suppliers must ensure that the fuel mix they distribute meets LCFS standards, offsetting any deficits with their own or purchased credits[16].

Singapore airport (SIN)

The regulatory framework outlined by the Singapore government will mandate the use of sustainable aviation fuel (SAF) on all departing flights from 2026, in line with the new sustainability plan unveiled by the government ahead of the Singapore Airshow. The plan outlines a strategy to reduce domestic aviation emissions from airport operations by 20 per cent by 2030 and to achieve net zero emissions for both domestic and international aviation by 2050.

The Civil Aviation Authority of Singapore (CAAS) launched the Aviation Sustainability Programme (ASP) in 2023, a 50 million dollars initiative aimed at funding sustainable aviation projects and fostering industry development. The first call for proposals took place in April 2023, with a second round scheduled for April 2024. Additionally, CAAS established the International Centre for Aviation Innovation (ICAI) to drive partnerships and innovation initiatives across all areas of aviation, with a strong focus on sustainability.

4.2 Transport system

London Heathrow (LHR)

Heathrow Airport uses a commercially operational driverless pod system from Ultra PRT at Heathrow providing a link between the T5 business car park and the terminal itself. The system was launched in 2011 with 21 pod service operates 22 hours a day. The service has reduced

congestion locally, saving Heathrow 70,000 shuttle bus journeys annually, which represents a yearly saving of 200 tonnes of CO_2.

Seoul Incheon (ICN)

Seouldi Incheon International Airport employs a high-speed magnetic levitation train (Maglev) for passenger transport. The project was launched in 2016 and connects the airport with the city, stretching six kilometres with six stations and reaching an operating speed of 110 km/h.

The route starts at Incheon Airport and serves key locations, including the long-term car park, administrative complex, International Business Centre, water park and Yongyu Station, providing a continuous and efficient connection for passengers and airport staff.

Amsterdam Airport Schiphol (AMS)

Amsterdam Airport Schipol has been involved in a hyperloop project since 2018 in partnership with Hardt Hyperloop, supported by EIT InnoEnergy. The parties involved conducted a study showing that the hyperloop can play an important role in making Schiphol the planned sustainable multimodal hub, predicting that the hyperloop can replace up to 12.5 million passengers travelling through Schiphol by 2050[17].

4.3 Community Development

Brussels Airport (BRU)

The Brussels Airport Fund, managed by the King Baudouin Foundation, has allocated 114,000 euros to support 13 sustainable and social projects in the airport's surrounding area. These initiatives cover a range of focus areas, including urban green development, such as the creation of a biodiversity-rich space at Nieuwland School and a 3,000 m² orchard at De Plek project. Environmental education projects include transforming a forest area into a recreational space in Melsbroek and raising awareness about water consumption in Grimbergen. The fund also supports circular economy and social inclusion efforts, with initiatives like the Repair Café promoting waste reduction and a bicycle repair workshop for young migrants. Additionally, projects like VELO cycling courses in Leuven and sustainable energy solutions, such as an aquathermal heating system in Molen van Rotselaar, aim to foster mobility and renewable energy[18].

Bristol Airport (BRS)

Bristol Airport introduced the Airport Environmental and Amenity Improvement Fund, dedicated to supporting initiatives that benefit the local community and mitigate any unforeseen negative impacts resulting from airport development. These may include environmental disturbances or effects on the overall quality of life in nearby areas.

The fund aims to foster a positive relationship between the airport and its surrounding communities by financing projects that enhance local environments, improve public spaces, or address specific concerns linked to airport operations. Through this initiative, the airport demonstrates its ongoing commitment to sustainable development and community well-being.

5 Conclusions

This paper provides an overview of how Partner airports integrate SAF regulations into their local frameworks, analyze their transportation systems, and implement community support initiatives.

At the European level, the ReFuelEU regulation has set ambitious targets, the specific implementation strategies are left to the discretion of Member States and local authorities. As a result, each airport, along with third-party stakeholders and energy management teams, must navigate the transition individually, leading to fragmented approaches. Most countries have opted to follow the general ReFuelEU guidelines rather than developing customized decarbonization pathways.

The analysis of partner airports' transport systems reveals that while rail and bus connections exist between airports and city centers, private car usage remains predominant among passengers. To promote sustainable mobility, it is essential to develop initiatives such as expanding electric vehicle charging infrastructure, enhancing public transport accessibility, and promoting multimodal transport solutions. Encouraging a shift to low-emission transport modes will be crucial in reducing the overall carbon footprint of airport operations.

Beyond decarbonization and transportation, airports also play a vital role in supporting local communities. Many initiatives focus on reducing air and noise pollution in surrounding areas, directly benefiting residents and ecosystems. Additionally, several airports are committed to biodiversity conservation, ensuring that local habitats are preserved and maintained. These efforts, combined with broader sustainability initiatives, demonstrate the growing commitment of the aviation sector to minimizing its environmental impact while fostering stronger community engagement.

Moving forward, a harmonized regulatory approach and coordinated sustainability initiatives will be essential in ensuring that European airports can effectively meet their decarbonization targets while enhancing the quality of life for local communities.

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