

EUROPEAN TRANSPORT REGULATION OBSERVER

The Role of Airports in the European Green Deal

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Highlights

The [European Green Deal](#) sets the objective of making Europe the first climate neutral continent by 2050: a commitment which places a particular responsibility on the aviation sector. In addition to calling for a reduction of the sector's climate footprint, the Green Deal stresses the importance of 'improving air quality near airports by tackling the emissions of pollutants by airplanes and airport operations'. Though important advances have been made in mitigating noise pollution from aircraft, noise levels continue to pose a serious health risk for communities living close to airports and, thus, also need to be further addressed. The Commission's more recent [Sustainable and Smart Mobility Strategy](#) reiterates the urgency of transitioning to zero-emission airports, whereby 'the best practices followed by the most sustainable airports must become the new normal and enable more sustainable forms of connectivity'. Against this backdrop, the [14th Florence Air Forum](#) examined the contribution of European airports and the wider aviation ecosystem, through technological and regulatory measures, in supporting the attainment of the European Green Deal and Climate Law objectives.

When it comes to technological solutions, measures to boost airports' energy efficiency, as well as the electrification of aircraft during taxiing, of ground handling, shuttle buses and other vehicles transporting passengers to-, from- and within the airport premises, for instance, are increasingly examined and implemented. In fact, the European airport industry has shown firm [commitment to becoming net zero for carbon emissions](#) by no later than 2050. Airports, however, do not operate in isolation, thus, any regulatory and financing measures to improve their environmental performance, will have to take into account the broader aviation ecosystem, including airlines, air traffic management and ground handlers, among others. Besides the roll out of greening measures at their own premises, airports are important interfaces between various operational stakeholders and can thus act as 'enablers' for broader aviation sector decarbonisation. To this end, the 14th Florence Air Forum sought to discuss how existing EU legislation (e.g., the [Airport Charges Directive](#), the [Slot Regulation](#), and the [Ground Handling Directive](#)), but also public funding opportunities (research funds, [Recovery and Resilience Facility](#)) can stimulate the greening of airports.

POLICY
BRIEF



Airports as ‘Enablers’ for the Aviation Sector’s Take-off Towards Net Zero Carbon Emissions

A comment by Matthias Finger and Teodora Serafimova, Florence School of Regulation – Transport Area

About a year ago, the European Commission adopted its [European Green Deal](#), which sets the ambition of making Europe the first carbon-neutral continent. To this end, a 90% reduction in greenhouse gas emissions by mid-century would need to be delivered by the transport sector collectively, with all modes contributing their fair share. While in the meantime, the onset of the COVID-19 pandemic has brought about unprecedented challenges for most sectors of the economy, it has also become clear that the Commission’s level of climate ambition remains unchanged. The recovery phase has been framed as an opportunity to accelerate the shift towards a more sustainable, smarter, and resilient mobility system. In its recently published [Sustainable and Smart Mobility Strategy](#), the Commission lays the foundation for how the EU transport system can achieve its green and digital transformation while becoming more resilient to future crises.

Aviation, in particular, has been among the most challenging sectors to decarbonise. This can be, at least partially, attributed to the sector’s fragmented nature, whereby the pieces that make up the sector are pursuing their own efforts to decarbonise and, at times, pulling in different directions. Unlike the other network industries, notably railways, electricity, and telecommunications, aviation has never been vertically integrated into one single State-owned company. Consequently, a systemic view has never been as pronounced in the aviation sector. A key message that resonated among participants at our [14th Florence Air Forum](#) was the need for a systemic approach to regulating the air sector. This becomes especially paramount when addressing the greening of air transport, where the efforts of the actors that constitute the aviation ecosystem will need to be coordinated, especially at its interfaces, to place the sector on a path towards net-zero emissions by mid-century. Below we take a closer look at one of these interfaces, namely the airports, and share some reflections on their role in aviation greening.

Low-Hanging Fruit for the Greening of the Aviation Sector

While it is well known that the actual flight is responsible for the vast majority of the aviation sector’s carbon footprint, airports themselves offer significant untapped potential for further and rather easy greening, especially when compared to airlines. Airports can make a sizable contribution to reducing aviation emissions by resorting to readily available technologies and practices. ACI’s Airport Carbon Accreditation program, which has been in use for over a decade now, manifests airports’ commitment to greening their assets in line with the net zero carbon objectives.

Greening efforts can touch upon many different aspects of an airport’s construction and operation. The discussions revealed that numerous airports, amongst which Hamburg airport, are undertaking measures to boost their buildings’ energy efficiency, renovating ventilation and lighting systems, and installing photovoltaic facilities onsite. On the other hand, others, such as Geneva airport, are financially supporting ground handlers in their operations’ electrification to reduce both emissions and operational costs. Airports are, moreover, seeking to improve public transport connections to city centers while promoting multi-modality and cleaner mobility forms. The AENA-operated Spanish airports, for instance, are electrifying shuttle bus fleets, installing the necessary charging infrastructure, and reinforcing electrical power grids. Schiphol airport is testing its taxi bot pilot, which allows aircraft to be towed from the runway with engines off, thereby saving kerosene and emissions.

Role Models and Enablers for Sector-Wide Greening

But there is more to airports. Unlike airlines and air traffic management (ATM), airports are locally rooted, often locally owned, and generally subject to higher local pressures than airlines and ATM. In addition to mitigating the CO₂ impact of their assets and activities, airports have to manage local issues, including air and noise pollution, waste generation, and the potential damage to local wildlife habitats and water bodies. The above constitute good reasons why airports can and should act as role models and enablers for the greening of the entire aviation sector.



Schiphol airport's experience of electrifying its bus fleet back in 2011 is an illustrative example of how airports rely on the actual products available on the market to green their operations and services. We have seen from the discussions that 'early mover' airports have several ways of responding to technological bottlenecks in the supply chain, from boosting their research and innovation efforts to reaching out to suppliers outside Europe, and actually co-developing the demanded products themselves. What is more, larger airports are taking greening measures beyond their premises by supporting renewable energy projects and partnering with sustainable aviation fuels (SAFs) producers. Airports can leverage their unique position as an interface between airlines, aircraft manufacturers, and developers of smart energy management systems to scale up SAFs production and deployment. Airports can accelerate the uptake of new aircraft technology related to electrification or hydrogen by securing the appropriate airport infrastructure, associated services, and, not least, set incentives.

What is more, we have seen that airports are increasingly becoming involved in the broader energy transition by procuring or self-generating carbon-neutral energy onsite. The enhanced cooperation between stakeholders from across the entire supply chain is key to enabling the uptake of SAFs and greening aviation. Of course, these possibilities will also depend on regional contexts.

A Conducive Regulatory Framework for Airports to Act as Enablers

While it is encouraging to see a handful of best practices today, shifting towards a more consistent effort across the airport community towards greening will necessitate enacting a conducive EU regulatory framework. One apparent market failure, and thus the need for intervention, was identified in ground handling: an industry marked by very low margins, rendering high upfront investments and greening considerations difficult. Greater involvement on the part of airports, through minimum CO₂ requirements in licensing calls for tenders, could accelerate greening in the sector. An overarching regulatory framework could also help to mobilise a collective effort towards greening, which is key to creating economies of scale and lowering the

higher initial costs of newer technologies, such as electric vehicles.

Additionally, airports need to be encouraged and supported to act as enablers. Airports have several instruments at their disposal to stimulate cleaner and quieter aircraft, including airport charges, incentives, operational rules, and slot regulations. Many airports are already modulating the charges paid by airlines based on environmental criteria, for example, by reducing charges for aircraft producing less noise and emitting less air pollutants such as NO_x. However, airports' ability to modulate charges largely depends on the applicable legislation, which varies from country to country.

Given their global impact, CO₂ emissions from aircraft, on the other hand, are not considered under the direct control of the airport operator. Notwithstanding, because of their revenue-neutral nature, the modulation of airport charges could be examined for the CO₂ emissions from aircraft to potentially provide an incentive for airlines to replace older fleets with newer and greener aircraft powered by SAFs. This possibility for airports to incentivise cleaner aircraft based on CO₂ emissions could be explored in the context of a revision of the EU's [Airport Charges Directive](#) and the [Slot Regulation](#).

All in all, some fine-tuning and revision of the EU regulatory framework will be needed going forward. The challenge will be to ensure a systemic approach and coherence across the different legislation pieces, from airport charges and slots to the Single European Sky's implementation, State aid, the internalisation of the external costs, and the EU's Sustainable Finance workstream (e.g., EU taxonomy for sustainable activities, EU Green Bond standard), among others. All of these are interrelated and contribute in one way or another to the advancement of the European Green Deal agenda. Last but not least, the future regulatory framework needs to reflect the fact that airports are complex systems of interrelated facilities and assets, which, in turn, has implications for the measurement and management of their sustainability performance.



Main Takeaways From the Discussion

By Teodora Serafimova, Florence School of Regulation – Transport Area

The [14th Florence Air Forum](#) took place in the midst of the COVID-19 pandemic, which has brought about unprecedented challenges for the entire aviation value chain, from airports, to airlines, ground handlers and retailers, among others. In fact, the Airports Council International (ACI) estimates that almost 200 airports could be faced with the risk of insolvency in the coming months if air traffic does not pick up. This, in turn, would result in considerable job losses and an overall reduction of connectivity in Europe. While airports are largely focused on their immediate survival, it is crucial that their recovery plans for the post-COVID-19 period align with the EU's climate neutrality objectives as laid out in the [European Green Deal](#). European airports have, in fact, already demonstrated their commitment to tackling the climate challenge by [collectively pledging](#) to achieve net zero carbon emissions by 2050. More recently, in November 2020, over 20 associations representing the entire European aviation ecosystem along with civil society, signed a [joint statement](#) for a post-COVID-19 recovery, which targets net zero CO₂ emissions for the aviation sector by 2050.

The emissions that airports directly operationally control (i.e., the emissions stemming from airport buildings, infrastructure, ground vehicles, etc.) account for ca. 2% of total global aviation emissions. Though for many of these airport-related emission sources, technological solutions for decarbonisation already exist, their implementation requires significant upfront investments, something that has been further complicated by the current context of COVID-19. Beyond these direct emissions, airports, as important interfaces between various operational stakeholders, have an increasingly important role to play in driving broader sector-wide emission reductions. To put things into perspective, the rollout of new aircraft technology related to electrification or hydrogen will be difficult to achieve in the absence of the appropriate airport infrastructure and associated services. Airports will, thus, be key enablers of broader sector decarbonisation.

Reducing CO₂ emissions from transport by 90% by 2050, as set out in the European Green Deal, will require

all transport modes as well as all actors in the aviation ecosystem to do their fair share in this collective effort. In addition to significant reductions in aircraft emissions, investments will also need to be channeled into airport infrastructure and operations in order to optimise air traffic performance on the airside as well as to improve the integration of airports into multimodal networks on the landside. The greening of airports is also among the key elements of the Commission's [Sustainable and Smart Mobility Strategy](#), which came out in early December 2020. The Strategy will shape the von der Leyen Commission's agenda in terms of the concrete actions that will be implemented to render the entire aviation ecosystem more sustainable, resilient and competitive.

The 14th Florence Air Forum was welcomed as a timely opportunity to discuss the concrete technological and regulatory solutions to stimulate the greening of airports in a holistic manner. These include measures to boost the energy efficiency of the airport premises, the generation of clean energy on-site, efforts to reduce emissions from airside activities, ground handling and ground operations of aircraft themselves, as well as efforts to secure the appropriate supplies and infrastructure for the uptake of SAFs. The regulatory and incentives framework are equally important, whereby the key objective will be to identify how existing European legislation, notably Directive 2009/12/EC on airport charges ([‘Airport Charges Directive’](#)), Regulation 95/93 ([‘Slot Regulation’](#)), but also the Directive 96/67/EC on the provision of ground handling services ([‘Ground Handling Directive’](#)), can stimulate the greening of airports.

As regards the financing aspects, whereas the bulk of the investments will stem from private actors, EU and national public funds, such as the [Recovery and Resilience Fund](#) and [InvestEU](#), will also have an important role to play. Though the latter are non-sectoral and demand-driven funds, it is clear that the transport sector, as one of the most severely hit sectors by the pandemic, will be a prime beneficiary of these funds. The greening of airports will be among the eligible segments within the Recovery and Resilience Fund, whose total budget amounts to €672.5 billion of loans and grants, and which will be rolled out on the basis of national plans. Not the least, the European Investment Bank (EIB)'s recently adopted climate policy is also set to provide financing opportunities for investments into the greening of airports.



What Are The Various Technological Options Involving Aircraft Ground Movements, Airside Operations and Ground Handling Solutions to Accelerate the Achievement of Net Zero Carbon European Airports By 2050?

The European Green Deal’s objectives are not limited to climate, but address broader environmental issues including biodiversity, water management, air and noise pollution. A broader vision of sustainability, which revolves around striking the right balance between the environmental, social and economic sustainability, is also reflected in numerous airports’ strategies.

The sustainability strategy of Schiphol airport, for example, is rooted in the idea of optimising performance across the four thematic areas of sustainable aviation, energy positive, communities, and circular economy. Whereas the circular economy and energy positive milestones are in the airport’s direct sphere of influence, sustainable aviation and communities are in its indirect sphere of influence. Schiphol Airport has set itself 2050 goals and intermediary 2030 milestones for these four themes, thereby closing the loop between the four milestones. For instance, the ‘plus’ in energy positive could be used to produce SAFs, or alternatively, it could be shared with the airport’s neighboring communities.

More specifically when it comes to its energy positive milestone, Schiphol aims to achieve net zero emissions by 2030, which is 20 years ahead of the recommendations by the Intergovernmental Panel on Climate Change (IPCC). The scope of this target includes all airside operations (i.e., handlers, cleaning activities etc.), except for aircraft emissions. The phasing out of fossil fuels has been considered as an important win-win strategy to not only reduce CO₂ emissions, but also to improve local air quality and thereby the working conditions for airport employees.

The switch to electric buses at Schiphol airport was met with some frictions back in 2011, when the airport first started investigating electric solutions. Initially, many of the buses running from Schiphol airport to the aircraft were autonomously operated diesel buses. However, because of the 30 kilometers per hour speed limit at airside, the bus engines were not heating up sufficiently, thereby exacerbating emissions. This, in turn, prompted

the airport to embark on the gradual electrification of its airport vehicle fleets. Despite interest from the airport to green its operations, there were certain technological bottlenecks in the European supply chain back in 2011-2012, which meant that electric solutions could not be easily delivered for four-wheel drive cars, which in turn were a requirement for airside operations. Schiphol responded to this by reaching out to suppliers from outside of Europe and a Chinese supplier was eventually selected.

Since 2011, electric technologies have matured significantly, and there is now a better understanding of the supplier communities among airports. Schiphol’s experience is an illustrative example of the fact that airports rely on the actual products available on the market in order to green their operations and services. A conducive regulatory framework can stir a collective effort towards greening, which in turn, could help to create economies of scale and render product development more economically attractive to manufacturers. Currently, Schiphol is testing out its taxi bot pilot, which is demonstrating that aircraft can be towed from the runway with engines off, thereby saving kerosene and emissions. This is just one example of how airports can act as enablers for the decarbonisation of airlines.

Discussions also focused on the reduction of emissions from the ground handling industry, and, in particular, sought to address the root causes behind its suboptimal progress with regards to greening. To put things into perspective, the total amount of CO₂ emitted by ground handling activities amounts to approximately 4 million tons of CO₂ annually, which is a small proportion as compared to the wider aviation picture. Ground power units are responsible for almost half of the total ground handling emissions, so phasing them out constitutes an important first step in rendering ground handling operations more sustainable. What is more, the electrification of ground handling equipment, using electricity from non-fossil sources, is a readily available solution today to reduce the sector’s emissions. The total market value of ground support equipment (GSE) is estimated at \$15 billion every year. Electric ground handling equipment today, however, only accounts for roughly 10-15% of the total stock. Numerous studies show that if all the operational costs (e.g., fuel costs, maintenance costs, battery change, etc.) are factored in



over a period of 15 years, the electric solution would almost always emerge as the more economically attractive one for the ground handler. So why are we not seeing a more rapid uptake of electric GSEs?

Despite their lower operational costs, electric GSEs cost on average 15-20% more than their current diesel counterparts. Here it is also particularly important to note that airline contracting and ground handling is a business characterised by low margins, whereby achieving 5% of margin on average is considered to be a good financial year, whereas the majority of ground handlers are barely achieving breakeven for years. Prior to the pandemic, ground handling was making an annual contribution of \$90 billion to the economy, though the drastic reduction in air traffic has resulted in massive disengaging from ground handling contracts and layoffs across the industry. As a very low margin industry, upfront investments into greening solutions, such as electrification, are particularly challenging for the ground handling industry. Stakeholders were in agreement that new regulatory approaches will be needed to rectify this market failure, and that it should be seen as an opportunity for airports to take on a more active role. In view of this, Geneva airport has implemented a programme, whereby the airport shares up to 50% of the investment costs for electrification with the ground handlers. As a result, their main ground handler has already electrified 50% of their equipment. Schiphol airport, on the other hand, has had a different approach as regards the deployment of their mobile electric ground power units. Because technological solutions were not available on the market, Schiphol has heavily invested in research activities, and has co-developed the electric ground power unit, which is now in testing phase.

The current EU regulatory framework governing ground handling is focused on the purely economic relationship between the airlines and the ground handlers, which in turn is dictated by the service level agreements. In the absence of legal obligations or incentives to choose their contractor on the basis of CO₂ emissions, airlines will continue prioritising financial objectives. Participants appeared to agree on the need for greater involvement from airports, which today are constrained in their ability to interfere in prescribing the type of ground handling equipment to be used. A number of airports are already introducing minimum CO₂ requirements in their licensing call for tenders, with the notable examples

of Oslo Gardermoen and the AENA-operated Spanish airports.

At AENA's airports, for example, ground handling licenses are awarded through tenders for the duration of five years, whereby each tender includes conditions for CO₂ reduction. Prior to each tender, workshops are conducted with stakeholders from the sector including ground handlers, manufacturers and regulators so as to define tenders compatible with the current market and regulatory realities. The pooling of ground handling equipment was brought up as another possible solution to overcome the lack of investment funds needed to embark on electrification. In sum, a 'push' would need to come from the airports in order to stimulate a more consistent approach among the ground handling community when it comes to greener solutions. To this end, a change in how the market works, and especially in how contracts and licenses are awarded, will be needed. A recommendation was put forward for greening conditions to be included in the tender requirements, which in turn, could be achieved through a revision of the Ground Handling Directive.

Airports, however, do not operate in isolation. Thus, any regulatory measures aimed at improving their environmental performance, would have to take into account the broader aviation ecosystem, including airlines and air traffic management (ATM). A systemic approach, which relies on a combination of technological and operational measures to deliver emission cuts throughout the different phases of the flight, will be key to ensure the aviation sector emerges from the COVID-19 crisis on a path to climate neutrality by 2050. The targets set out in the European ATM Master Plan, published at the end of 2019, remain fully valid today.

The current regulatory framework places a strong emphasis on the management of capacity in the air. To illustrate this, in response to the capacity crisis of 2018-19 and the resulting huge flight delays, it was decided to redirect traffic to where there was spare capacity, even if this translated into inefficient and more polluting flight paths. To put things into perspective, while air traffic only increased by 3%, CO₂ emissions increased by 7% during that period. This is a clear illustration of how the regulatory environment can shape the behavior of the various actors and undermine environmental objectives. Improvements in the scalability and capacity



of the whole network can help to improve environmental performance.

While many airlines have been making efforts to increase load factors of their aircraft, there is still a prevalence of fuel tankering practices, whereby aircraft deliberately carry excess fuel in order to reduce or eliminate refueling at their destination due to higher fuel prices. This, in turn, acts to undermine the climate effects of increased load factors. Participants argued that COVID-19 can be turned into an opportunity to rebuild the aviation system, so as to ensure consistency and embed environmental principles into regulation.

Realising the full potential of SAFs uptake onboard aircraft will require measures to ensure that aircraft follow the most efficient trajectories in the sky. Continuous Climb and Descent Operations (CCOs and CDOs), whereby aircraft are allowed to follow flexible, optimum flight paths, for instance, can deliver important environmental and economic benefits, in the form of reduced fuel burn, emissions, noise and fuel costs. Similarly, avoiding holding patterns before landing (i.e., aircraft flying in circular patters before they can land), can lead to significant fuel and CO₂ savings.

While the bulk of the CO₂ emissions evidently stem from the flight and fuel burn, the discussions showed that there is a significant potential for action also on the ground. A set of tools and functionalities at the disposal of air traffic controllers at airports can support them in handling complex operations and optimising phases. Improved airport operations, optimised taxiing and runway usage can help to avoid unnecessary fuel burn. Not the least, the airport plays an important role as an enabler for the decarbonisation of the entire aviation value chain and can offer synergies for various actors, including the ground handlers, airlines, but also the suppliers and manufacturers of the necessary equipment to make that greening possible.

Greening Airports: From Construction to Electricity Generation, Availability Of Sustainable Aviation Fuels and Transit to The Airport. How to Build and Operate Airports in a Sustainable Way?

On the one hand, airports can be viewed as buildings or factories, and thus not much different to the rest of the economy and other fixed infrastructures when it comes to their greening. The way in which airports are constructed and operated to a large degree determines their carbon footprints. On the other hand, we should note that airports are located between two other categories of emissions, namely those that passengers emit to reach the airport, and these emitted during the actual flight. Airports have an important role to play in driving reductions from both of these emissions categories. However, the airport sector should not be approached as a monolith, given that different airports have different sizes and capabilities. Some of the bigger airports, for instance, who are the largest fuel suppliers and are often connected to pipelines, would have an especially important role to play when it comes to deploying SAFs. A uniform standard for airports in regards to greening may thus be a challenge due their heterogeneity.

The experience of Hamburg airport illustrates how the implementation of environmental management practices can help to reduce an airport's carbon footprint. Notably the airport has reduced its footprint from around 38 000 tons of CO₂ back in 2009 to roughly 14,000 tons of CO₂ in 2019. A major source of CO₂ for Hamburg airport has been the building sector and facilities, and in particular their energy demand and efficiency. Therefore, as a first step, the airport has changed its ventilation and lighting systems, and implemented a new energy management software. New, more energy efficient, buildings were built to replace older ones. Important emission savings were achieved through the procurement of carbon neutral electricity from wind power.

Ground support equipment (GSE) accounts for ca. 25% of Hamburg airport's emissions. To reduce these, the airport has exchanged diesel-powered vehicles by electric vehicles, especially where these run over shorter distances. Compressed natural gas (CNG), on the other hand, has been used for buses and for luggage handling tractors for longer range deployment. Notwithstanding, Hamburg airport aims to replace the latter with hydrogen-fueled



vehicles in the near to mid-term future. These measures have been followed by the installation of charging and fueling stations on the air- and on the landside. In the more immediate term, the airport will be constructing a new baggage handling system, which will be equipped with a photovoltaic (PV) facility to produce hydrogen for the next generation of hand luggage tractors.

Electricity supply has been implemented on all aircraft stands (also on remote stands) to replace both auxiliary power units (APU) and ground power units (GPU). Hamburg airport's apron was also refurbished and equipped with a modern LED-based lighting system. The creation of parallel taxiways has helped to avoid aircraft congestion. While there are plenty of measures that airports can undertake on their own premises to cut emissions, as underlined earlier, they are also crucial when it comes to SAF deployment, given their role as a link between the suppliers and the airlines. In recognition of this, a new project called Kerosyn, founded on a cooperation between Hamburg airport and a local refinery, plans to use wind power and atmospheric CO₂ to produce climate neutral jet fuel to be supplied to airlines in future.

The Spanish airport operator AENA, on the other hand, has announced plans to achieve net zero carbon emissions by 2040, which is 10 years ahead of the joint ACI Europe commitment. To this end, last year AENA launched its PV plan, which foresees 100% of self-supplied electricity from renewable sources in AENA airports by 2026. The facility has an annual production of 950GW, which is the equivalent to the annual consumption of 280,000 homes. This project will entail an investment of €350 million and will cover the surface of 740 hectares in 14 airports.

The main decarbonisation actions currently executed by AENA include the construction of self-consumption renewable energy facilities, the purchase of 100% renewable energy with guarantees of origin in all the airports of the network, energy efficiency actions mainly in electricity and air conditioning, and the promotion of inter-modality and sustainable mobility. In the short term, AENA is focusing on the replacement of diesel vehicles with electric vehicles, promoting the deployment of a network of electric charging points in the car parks for passengers and employees, and the reinforcement of the electrical network. In the medium term, AENA is planning for the development of hydrogen technology as

fuel and as an electrical energy storage. AENA airports also have a close relationship with aviation fuel logistics operators, as they manage the construction and operation of the fuel infrastructure at its Spanish airports.

As mentioned earlier, greening efforts must go beyond the airport operator's emissions. When it comes to the technological solutions, there is growing consensus that a combination of SAFs and aircraft design will be necessary to achieve significant emission cuts from the sector. When it comes to fuels, an emphasis has been placed on advanced biofuels and synthetic kerosene, whereas electrification could play a role for short haul flights.

Current production of SAFs is low, but the share can be increased with coordinated regulatory support. Airports can leverage their unique position as an interface between airlines, aircraft manufacturers and developers of smart energy management systems, to scale up SAF production and deployment. Cooperation of stakeholders from various parts of the supply chain is key to enable uptake of SAFs, though the possibilities will very much be shaped by regional contexts.

In addition to regulation, voluntary industry initiatives have an important role to play in stirring the greening of airports through the provision of reputational incentives. The [ACI Airport Carbon Accreditation programme](#), launched in 2009, is a particularly interesting example of such an initiative, based on existing, cross-industry standards for carbon management. Initially this programme was based on four increasingly stringent levels of accreditation (from 1 to 3+). On the first level of accreditation, an airport conducts a mapping out of its own emissions, defines action plans and sets CO₂ reduction targets. Subsequently, the airports gradually expand the scope of their efforts to also cover third party emissions.

In order to support airports' path to net zero emissions by mid-century, ACI recently announced the introduction of [two new levels of accreditation](#), namely level 4, also called 'transformation level', and level 4+ or 'transition level'. In order to be accredited at 'transformation level', an airport needs to define emission reduction targets only in absolute terms (i.e., the setting of CO₂ reduction targets per passenger do not suffice), whereby the level of the target needs to be aligned with the Paris Agreement (i.e., consistent with the IPCC scenarios defined for the 1.5 and 2 degrees pathways). Another novelty as compared



to the previous levels is that airports accredited at 'transformation level' will, under certain conditions, have the possibility to include third party emissions into their target scope. Level 4 accreditation includes a requirement for an extended carbon footprint in particular in relation to third party emissions, and a strengthened requirement as regards stakeholder engagement. 'Transition level' 4+, on the other hand, includes all of the above-mentioned requirements, plus the offsetting of residual emissions. In light of its global scope, the Airport Carbon Accreditation programme has had to balance the needs and contexts of different airports from around the world in defining the different accreditation levels. Notwithstanding, the programme is aligned with the EU's climate targets, and a total of 329 airports worldwide, accounting for ca. 45% of global air passenger traffic, are carbon accredited today.

The proper accounting of airport emissions was another key element brought up during the discussions, as not all EU Member States are fully integrating the climate impact of airport expansion into their plans today (e.g., currently ongoing legal case on London Heathrow). Participants expressed support for the need to ensure that airport expansions are preceded by comprehensive environmental impact assessments.

What are the Various Regulatory Options (E.g., Airport Charges- and Slot Regulation) Supporting the Shift Towards Greener Airports? What are the Funding Possibilities to Enable Greening of Airports?

Airports have a number of instruments at their disposal to stimulate cleaner and quieter aircraft, including airport charges, incentives, operational rules and slot regulations. Airport charges, for instance, can be adapted to the noise or emission type of the plane. Alternatively, charges can also be adapted to the time of flight (night or day), in particular to tackle the issue of late night flights caused by delays. In Geneva airport, for instance, noise charges were increased for noisier aircraft three years ago. As a result, several companies have changed their planes from A330 to B787, A320 to Neo, or to A220.

Incentives, on the other hand, can be used to favour airlines with higher load factors. Prior to the pandemic, in Geneva airport load factors of above 90% had been reached for both of their main airlines, which in turn has helped to reduce emissions per passenger. Furthermore,

incentives can be given on the basis of airplane type, so as to incentivise airlines to bring into operation the last generation of planes which are linked to benefits in terms of both noise and emissions. Lastly, incentives can be used to support new fuel use, for which the price remains higher than that of conventional jet fuel. Operational rules can, similarly, be used to regulate noise levels by prohibiting take offs after a certain evening hour, and to introduce night bans for planes other than last generation. Slot limitations, on the other hand, can be introduced on the basis of plane types and other objectives.

Whereas airport charges have a primary purpose of cost recovery for airports to cover their internal costs, the modulation of charges, be it on the basis of CO₂, NO_x or noise, must be revenue neutral, meaning that no additional revenue is generated for the airport as a result of these modulations. Therefore, while modulations cannot be used to generate revenue for a low carbon fund for instance, they can help to incentivise the uptake of cleaner and quieter aircraft.

While there was general consensus over the usefulness of modulating airport charges in order to stimulate airlines to invest in quieter aircraft and tackle local issues such as noise pollution, there was disagreement among stakeholders about the question of whether modulation of airport charges on the basis of CO₂ emissions is an appropriate instrument to stimulate SAFs uptake by airlines. What is more, there was disagreement as to whether the modulation of airport charges on the basis of CO₂ can effectively lead to a change in airline behavior in terms of uptake of cleaner aircraft.

Proponents of a charging system based upon individual emissions of aircraft argued that aircraft that emit more should pay more, as long as airports also enable possibilities for airlines to reduce their emissions, by providing the necessary infrastructure for example. Furthermore, it was noted that modulations on the basis of CO₂ can act as a nudge for airlines to accelerate fleet renewal and uptake of SAFs-powered aircraft. What is more, there is a risk that if an obligation is imposed on airlines for the deployment of SAFs, airlines may take legal action against the application of the fuel mandate (e.g., US airlines have a track record of litigation in Europe). In view of this, some stakeholders argued that an obligation may be better placed on the level of the airport and the fuel supplier.



According to airlines, however, the airport level is not the appropriate level to regulate CO₂ emissions, and it was thus argued that airport charges should remain strictly consistent with the cost of infrastructure. Instead, it was cautioned that aviation regulations on CO₂ need to be set at the highest level possible in order to mitigate the risk of carbon leakage (i.e., the risk of merely shifting emissions and air traffic from countries with more stringent environmental regulations to ones with weaker or no regulations, as opposed to reducing emissions). This in turn, opens up competition concerns among air carriers operating in jurisdictions with different regulations. A Europe-wide strategy to increase and facilitate the uptake of SAFs will thus be key. Airlines, furthermore, argued that airport charges modulated on the basis of CO₂ will only have a marginal impact on airline behavior and on global climate. Even in the absence of regulations, airline stakeholders insisted that their behavior is influenced by natural economic incentives to become more efficient in terms of aircraft type and engines, given that these are less consuming and enable cost-savings.

Drawing on the above, a message that emerged from the discussions was that the decision as to whether modulated charges are to be applied is best determined at the local level by each individual airport in consultation with the airlines. Given that there is no solution that fits all, flexibility will need to be maintained in the regulatory environment. What is more, it was noted that the pursuit of flight route optimisation may sometimes lead to inconsistencies or trade-offs between environmental objectives. To illustrate this, obtaining lower CO₂ emissions through a more direct route can result in higher noise levels for local communities, which are no longer avoided. This, of course, underlines the need to ensure the right balance is stricken, whereby the role of charge modulations was particularly stressed for addressing local environmental impacts.

As regards the EU financing opportunities, the European Commission has recently launched a combined European Green Deal call for ports and airports, whose primary objective is to reduce the amount of emissions generated by transport, and stimulate the shift to smart and sustainable mobility. The call is organised along several clusters, including sustainability (e.g., the uptake of SAFs), smart operations (e.g., using appropriate IT tools), multimodality (e.g., integrating multimodal connections

to city centers or to other modes of transport such as rail), and ‘other’ aspects relating to the built environment (e.g., energy efficiency). The overarching objective of this call is to pool together different actors, also from outside Europe, with a view to test solutions locally, scale them up and adapt them to different contexts in terms of airport sizes and traffic volumes.

Conclusion

Aviation can be viewed as a fragmented system, whereby the pieces that make up that system are pursuing their own efforts to decarbonise and, at times, pulling in different directions. It is clear that these individual pieces and efforts need to be coordinated, in particular at the interfaces. The 14th Florence Air Forum focused on one of these interfaces, namely the airports. Two main takeaways emerge as regards airports’ role as interfaces in achieving the European Green Deal objectives. Firstly, airports can enable the decarbonisation of other stakeholders in the aviation value chain, notably by providing the necessary infrastructure and supplies for SAFs uptake by airlines. Another key role for airports as interfaces is the provision of incentives to the other parties (e.g., charges modulation for airlines and tender specifications for ground handlers) to incentivise the greening of their operations.

The airports themselves offer important ‘low hanging fruit’ when it comes to decarbonisation. Drawing on the experiences of airports and other aviation stakeholders, however, some important bottlenecks need to be addressed. Firstly, there are operational bottlenecks, which pertain to technological challenges with regards to deploying electric vehicles at the airport premises for instance. Secondly, there are investment bottlenecks which are also particularly visible in the case of electrification, which only displays its cost savings potential in the longer term. This has been clearly illustrated in ground handling, where the limited contracting period and low margin nature of the industry prohibit significant upfront investments. Incentives will play a key role in bridging these investments. Some investments targeting greening will inevitably increase airports’ costs, which in turn, raises the question of how these higher costs are to be financed. One obvious approach will be for the customers of the airports, namely the airlines as their biggest customers, to shoulder these higher greening



costs of the infrastructures by paying higher charges. The EU taxonomy for sustainable activities will be crucial in helping to identify the right investments to allow airports and aviation more broadly to decarbonise.

To conclude, the 14th Florence Air Forum provided a platform for discussion on the broad range of tools at our disposal to stir the greening of airports. Firstly, financial incentives (e.g., the design of taxes and charges) or public funding (e.g., research funds, Recovery and Resilience Facility) can be provided. There are also reputational incentives, in the form of self-action from the industry, whereby ACI's Carbon Accreditation programme has been one particularly successful example. Though not extensively discussed during the forum, the Commission is currently exploring the possibility of introducing an environmental label for the aviation sector. All of the above measures will need to be carefully monitored to ensure that environmental regulations do not compromise the industry's competitiveness, and that there is no carbon leakage, which in turn could undermine the effectiveness of the measures.



Who Foots the Bill?

A comment by Juan Montero, Florence School of Regulation – Transport Area and UNED (Madrid)

Greening projects do not always entail an increase in infrastructure operating costs. Some projects reduce emissions just by increasing efficiency. This is the case of more direct air routes. Some projects might require a large initial investment but they bring a long term return. This seems to be the case of thermal insulation of buildings (including airport terminals) and also of electric vehicles. Even if these projects do not increase costs in the long term and may, in fact, result in lower operational costs, the challenge will be the financing of their higher upfront costs in the short term.

However, reducing emissions will often require an investment which increases airports' operating costs. In these cases, it is necessary to decide how to distribute this new cost across the aviation ecosystem: public authorities, airport managers, airlines, passengers, etc. Furthermore, it is necessary to ensure productivity in this kind of investment, identifying the right priorities and promoting the most efficient technology and the most efficient solutions to reach the emission reduction objectives.

The crucial question is who should foot the bill for the greening of airports. The trend over the last decades has been to pass the infrastructure cost to the infrastructure users, reducing the share of the burden on public authorities and tax payers. In the case of airports, the immediate users are the airlines, and the indirect users are the passengers (and also the cargo shippers).

This principle seems valid also for greening costs, following the 'polluter pays' principle and the overall policy to internalise external costs. Airports' investment to reduce emissions would be passed to airlines in the form of higher airport charges. Such charges would then be passed to passengers and shippers in the form of higher fares.

However, the case for state funding seems strong in some particular cases and at least, to partial extent, also for more profitable airports. Airports with weak business cases but general interest objectives (islands, remote areas, regional airports) might require state funding to green

their infrastructure and operations. Even larger airports might struggle to fund investments that do not improve their business case in terms of increasing capacity or improving facilities for passengers. State funding would accelerate investment and ensure the earliest effective reduction of emissions.

Funds are available in the European Union for decarbonisation, particularly in the framework of the post-COVID-19 Recovery Fund. The greening of airports seems particularly well-suited to attract funds. These are the kind of projects that the EU and the Member States want to finance to reduce emissions and incentivise economic activity and growth.

A further challenge will be to ensure investment in the right projects, namely, those that increase productivity while effectively reducing emissions, particularly in a fragmented and complex ecosystem with numerous actors, as is the case of aviation and airports.

Overinvestment in infrastructure to be operated under exclusive rights or under limited competition is a well-known criticism in aviation. The existing regulatory framework provides instruments for airport managing bodies to justify the need of investment, and for the airlines to contest the airports' plans. Directive 2009/12/EC on airport charges imposes on airport managing bodies the obligation to consult with airport users before plans for new infrastructure projects are finalised (Article 8). A consultation process is defined in the Directive (Article 6). As described in the Directive 'It is vital for airport users to obtain from the airport managing body, on a regular basis, information on how and on what basis airport charges are calculated. Such transparency would provide air carriers with an insight into the costs incurred by the airport and the productivity of an airport's investments. To allow an airport managing body to properly assess the requirements with regard to future investments, the airport users should be required to share all their operational forecasts, development projects and specific demands and suggestions with the airport managing body on a timely basis.'

The emission reduction objectives require new types of projects, deploying new technologies and new solutions. The application of the traditional regulatory instruments might require a refinement to identify priorities and guarantee the productivity of an airport's investment. The



ongoing works on taxonomy to measure emissions and to gain a better understanding of specific technologies and solutions to reduce emissions are preconditions to justify the objectivity, proportionality and productivity of the investment plans. Greening should not be inefficient, or a justification for non-necessary investment.

The definition of the right incentives requires to take into consideration the complex ecosystem around airports. For instance, ground handling companies are subject to contracts with airports to deploy their facilities and services, and then to contracts with airlines to charge for their services. Both contracts have to be coordinated so ground handling companies have the financial resources and the incentives to reduce emissions.



Reducing Emissions at Airside: Reflections from the Viewpoint of an Airport

A comment by Denise Pronk, Royal Schiphol Group

Airports have a lot in common with cities: shops, traffic, visitors, business people, but also sustainability issues like energy consumption, waste, people with reduced mobility or who need other forms of support. Airports have to be resilient to future changes. As our climate continues to evolve, more extreme weather and climate-related events are expected. The frequency, intensity, spatial extent, duration and timing of extreme weather events are expected to increase, making flight disruptions and cancellations more likely.

Like cities, the carbon emissions of airport operators are covered in the 2015 Paris Agreement. Most airports in Europe are committed to net zero carbon emissions by 2050, and globally many airports are aligning with this long term goal as well, despite the unprecedented challenges the sector faces due to COVID-19.

At an airport, many activities are operated by third parties. This situation complicates carbon management, since many of the emission sources are not under the control of the airport operator. Other users of airports, including airlines, concessionaires and ground handlers, play an important role in improving overall emissions at airside and landside. The Airport Carbon Accreditation of Airports Council International (ACI) is a benchmark to monitor the emissions in scope 1, 2 and 3. The standardisation of carbon management helps to share best practices. The ACI Europe sustainability strategy aims also to accelerate the development of strategy and execution at airports.

To decouple growth from activities level – number of flight movements and passengers – is key, but difficult with large fixed infrastructure. And, it is not only their own net zero goal that airports are working towards. Airports are pushing the envelope for a net zero carbon aviation sector in 2050. The responsibility of Schiphol airport goes beyond its own activities and focuses on reducing emissions inside the aviation sector.

The reason airports are frontrunners in cutting emissions is twofold: firstly, airports are motivated to contribute to the Nationally Determined Contributions of the countries they are located in. Secondly, by reducing their own emissions and facilitating emissions of partners in the value chain, airports are enablers in transforming the aviation sector into a sustainable one.

A big step is to shift to renewable energy, generated by additionally built wind or solar farms. Electricity emissions (scope 2) are much higher than scope 1 emissions. However, large volumes of renewable electricity are scarce, and are an important element for sustainable aviation fuels and hydrogen. For airports it is key to continuously lower their energy consumption – with a lower energy bill as a win-win outcome – and increase local generation and storage of renewable energy in facilitating the transition from fossil fuels to electricity or hydrogen. The Green Deal can support this transition by developing an overarching EU energy policy.

An advantage of airports – especially at airside – is that they are closed environments. The distances are relatively short, maximum speed is limited, the users are familiar with the field and there are few operations during the night. Because of its high sustainability ambitions, Schiphol airport looks for new and environmentally-efficient ways of working while conducting its airside operations. These innovations are often not immediately available, so the airport can help to co-develop them. Airside can serve as a testing ground for new innovations like electric vehicles and ground equipment. It could enable new technologies and products in other sectors. However, it is important that innovations are beneficial for other sectors in order to secure sufficient demand for the products and services and thereby render them financially attractive. Airports' influence can range far beyond their own activities. The Green Deal can address this requirement in research and development projects. Even more important is to focus not only on the capital expenditure but on total life cycle – and not solely on the costs but also the value it creates on social and environmental areas. An integral approach is key to make sustainable products and services mainstream.

Of course not all sustainability improvements are implemented smoothly. During the financial crisis Schiphol airport invested in Fixed Power Units to lower its environmental impact. However, Schiphol did not



sufficiently take into account the impact on working conditions of the handlers. Furthermore, introducing new ways of working requires the ability of employees to adapt. Organisations inside and outside the aviation sector have to be aware of this and pay attention to clear communication. Safety is a prerequisite in everything that happens at an airport, but in a controlled environment with a coalition of the willing it is always more possible.



Airports: The missing Link between Aviation and its Decarbonisation

A comment by Andrew Murphy, Transport & Environment

Airports and aviation's climate impact are synonymous with each other. Climate activists hold up planned airport expansion as an example of our shared unseriousness in efforts to address the threat of a rapidly warming planet. There is a truth to this accusation: if we build the runways and terminals, more aircraft will land. And right now, these aircraft remain almost exclusively dependent on fossil fuels. This means that airports indirectly contribute to global warming. Campaigners are therefore right to oppose airport expansion, and even to call for some oversubsidised airports to close.

But it's not just climate change campaigners who have a right to be worried. All of those who want our world to be better connected should be concerned about the aviation sector's direction of travel. While other sectors such as electricity and road transport accelerate their decarbonisation, the aviation sector risks being left behind. At a time when sustainability is becoming the driving factor in a company's resilience, aviation needs to act now lest it quickly becomes fossilised.

Airports will be especially exposed to climate change and its politics in the years to come, for they are the most unmovable aviation assets. Unlike aircraft, airports cannot be moved to regions where the warming or flooding effects of climate change are less acute, or where the regulatory environment is more favourable.

This, however, can turn airports into allies in our efforts to drive decarbonisation in the sector. To play that role, airports need to act on two fronts: first, not worsen the problem; second, start delivering new solutions.

The first front requires governments and airports themselves to accept that, at least in developed countries, a temporary halt to airport expansion is necessary. Don't worry: a temporary halt need not mean permanent blocking. As the UK's Committee on Climate Change recently [recommended](#), 'There should be no net expansion of UK airport capacity unless the sector is on track to sufficiently outperform its net emissions trajectory and can accommodate the additional demand.' The focus

should be on decarbonising the sector now, rather than let the problem snowball. Once decarbonisation has taken off and aviation has caught up with other sectors, airport expansion can again be considered.

The second front requires airports to play a lead role in reducing the aviation sector's emissions. That goes beyond decarbonising their own activities, such as vehicle ground fleet and terminal energy consumption. Instead, airports need to be more proactive in deploying technology which can help decarbonise the full scope of aviation emissions. At present, the most viable pathway is alternative aviation fuel, such as synthetic kerosene derived from additional renewable electricity and CO₂ captured from the atmosphere. There is one caveat in this alternative fuel pathway: it is essential that airports only support these new fuels, and don't give any support to the sort of crop-based biofuels which compete with the planet's food and forestry needs.

What is the role for regulators in all of this, be they EU-level or national? First and foremost, there should be a recognition that the approach to date, i.e., leaving aviation emissions largely unregulated, has done the sector a disservice. International aviation emissions have been excluded from national climate plans, which is inconsistent with the economy-wide targets of the Paris Agreement. This ineffective position urgently needs to be toppled, as some [are already demanding](#).

Excluding international aviation emissions from climate targets may provide short-term relief from taking meaningful action, but has allowed our planet's long-term climate problem to build up. All of us are already paying a hefty price for the aviation sector's marriage of interest with passive governments. Both have swept aviation's burning climate problem under the carpet.

Paris Agreement targets, known as nationally determined contributions (NDCs), should include all aviation emissions based on fuel sales. That is the start of a more aggressive programme of support to help the sector decarbonise. The programme needs to be combative because the sector needs to urgently step up its decarbonisation game. Both regulators and the sector need to adopt a "big bang" approach and to develop an ambitious industrial policy.



What would such an industrial policy look like? It would of course contain funding for research and development, but more than that, it would be a set of policies which would involve clear targets and timelines for new technologies to be developed and deployed. It would also include end dates for the use of fossil fuel in the sector, starting with the shortest journeys. These policies should be established at European and national level.

Airports have a central role to play in supporting this game-changing policy shift, for they are the missing link between the aviation sector and its clean future.



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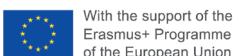
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