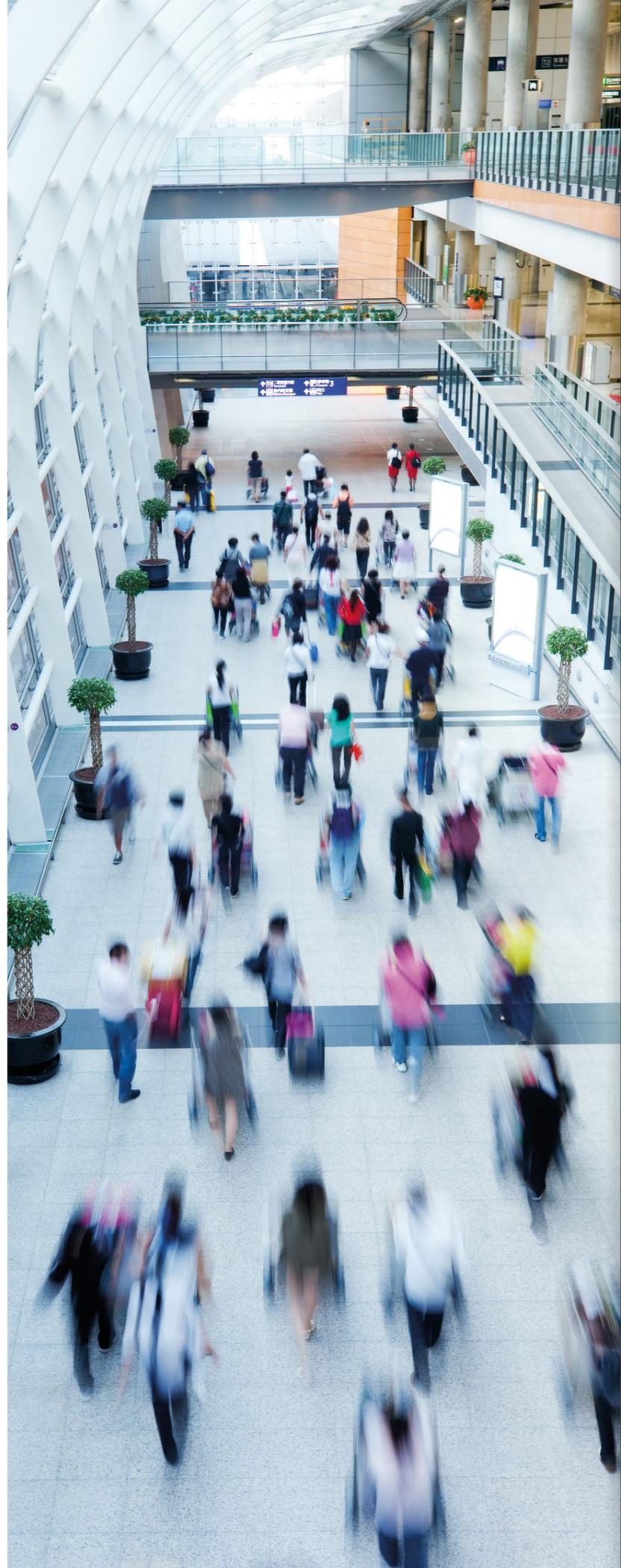




# The Future of Airports

A customer-centric experience



# Contents

- 03 – Introduction
- 04 – Airports aren't islands
- 06 – Customer champions count
- 08 – Mobility matters
- 10 – Customer-centric design
- 12 – Serious about sustainability
- 14 – Making it happen

## The case for customer-centric airports

The world has never been so accessible. The invention of flight has turned into one of humankind's greatest enablers - connecting people, communities and companies - and opened up the world to those that can afford the price of a simple plane ticket.



**Nick Hutchinson**  
Global Leader - Airport Solutions

In 2018, airlines alone created around \$821bn of revenue on some 4.3bn passengers flying safely on 46.1m flights, according to ITAT, and ATAG estimates that the total aviation industry employs over 65m people with a global economic impact of around \$2.7trillion from its many associated services.

These economic benefits don't come without costs, however. The highly competitive nature of the airline industry and the continued pressure on airport infrastructure both new and old means that airport operators are facing unprecedented challenges.

To meet the expected growth forecasts (a potential doubling of demand within the next 20 years) airport operators need to deliver their infrastructure upgrade and expansion programmes as efficiently as possible - and manage their existing assets more effectively - against a backdrop of falling retail revenue, downward pressure on fees earned through airlines, and a revolution in the expectations of passengers on the experience they expect from an airport.

Within the constraints of this competitive environment, airports need to focus just as hard on attracting customers - to become an airport of choice - as they must on sustaining their infrastructure and adapting or improving their existing business models.

This white paper explores how airport owners and operators can balance the competing needs of preparing for the future while catering for the customer expectations of today.

We examine the industry through the lens of five major trends:

- Enabling the airport city: although airports have positively enabled globalization, they can only survive and thrive if they have the support of their local community;
- Championing the customer: by embracing the opportunities of digitization, passenger pain points and frustrations can be alleviated and even eliminated;
- Embracing the challenge of mobility: by integrating airports with as many different modes of transport as possible, and embracing the efficiency opportunities of autonomous vehicles, airports can revolutionize how passengers get to airports, how they travel around it, and how they get to their final destination;
- Customer-centric airport terminal design: it's not enough to be innovative, efficient and sustainable; airport operators must also integrate the needs of customers into their terminal-design decisions;
- Being serious about sustainability: the obligations and regulatory requirements on the global aviation industry will only increase as the world confronts the climate-change challenge.

## Airports aren't islands

Very few airports exist in isolation. Despite their status as enablers of globalization, most airports can only survive and thrive with the support of their local communities.

In this new way of thinking, airports are no longer sterile, transactional places for waiting and passing through. Instead, they are more like smart cities, where place-making, entertaining, and information access is just as important as the provision of economic benefits and long-distance travel. And, like cities, they will only thrive if the metropolitan areas around them can also flourish.

Airports need to consider what it will be like to work, live and travel in the surrounding area, and how it can drive and support technology-based economic development within a surrounding smart city region.

This conundrum is at the heart of the challenge facing airport operators as they plan for the future. Unless an airport's facilities drive the local economy forward and provide benefits back to the community, local politics can hamper or even stop progress in its tracks.

This means addressing not just the obvious issues of noise, pollution, air quality and congestion, but it also means tackling human factors head-on. By embracing positive community outreach, airports can show how the community can feel connected to the airport – and not just feel the jet blast of arriving and departing planes.

### Mastering planning

To thrive in the future, airports need to view themselves in a different way. They need to think of themselves within the context of an airport city – or 'aerotropolis' – where the area surrounding the airport is just as important as the airport itself, enabled by the airport's infrastructure and economy. Schiphol Airport in the Netherlands, for example, earns as much as 80 percent of its operating revenue from areas other than aviation – retail, hotels, leisure and entertainment, R&D parks, light industry and logistics – and it is not alone in this.

Dallas/Forth Worth International Airport's vast land mass is being exploited to create new commercial developments that are affiliated with the airport's economy.

Airports are already significant employers for the local community – potentially up to 50,000 people in some of the largest – but the infrastructure that these places create can also provide significant community benefits. By taking a long-term view of an airport's infrastructure upgrade programme, communities can be brought into an airport's sphere of influence in a beneficial way. Think of the positive impact that interconnecting metropolitan railways can have on improving regional connectivity.

Enabling regional powerhouses  
Like cities, airports will need to interconnect with the region around it and become a catalyst for aviation-related economic development, high value employment and regional competitiveness. There is a real opportunity for airports to move away from being simply a functional and transactional transport hub to become an engaging, high-quality experience for passengers and citizens alike.



Schiphol Airport

*"There's nothing like an airport for bringing you down to earth."*

Richard Gordon, Novelist

# Customer champions count

It's not often you find someone who actively looks forward to going to an airport. Perhaps this would be different if every trip to the airport today was queue and crowd-free. But for airports to succeed in the next 20 years, they will need to find ways to make the whole customer experience much more positive than it is today.



*“There are those airports which make you feel better, and there are those airports that, when you go there, your heart sinks: you can't wait to get out of there. They both function as airports, but it's the things that you can't measure that make them different.”*

**Norman Foster**

Global customer satisfaction surveys reveal that the most important factors affecting customer satisfaction today are security, retail, food and beverage, infrastructure, wayfinding, check-in and access. These issues are likely to dominate in the future too. But airports have a clear opportunity to champion the customer by taking advantage of digitization to reduce or even eliminate the most pressing passenger pain points and frustrations.

## Facing forward

One particular source of innovation is the use of facial recognition technology and biometrics. Apple's new range of iPhones have brought Face ID technology into the mainstream, and some airports have already begun embracing biometrics to reduce check-in and security-check times. These same biometric technologies will also be linked with baggage, allowing for a lower-risk, lower-stress baggage drop-off and collection routine.

The check-in process is already automated at most airports, with passengers able to check-in beforehand, reserve and change seats, and this has resulted in significant reductions in check-in queues within some airports. There's room for major progress, though. Airports such as LAX and Schiphol Airport have implemented biometric check-ins, but the approach is far from common.



## “Where did I put my bags?”

Airports such as those in Copenhagen, Switzerland and Hong Kong have embraced the process of de-coupling passengers from their baggage by using electronic RFID tagging and linking this with the check-in process. In this way, passengers can drop their baggage off in downtown (in the case of Hong Kong, it's the MTR subway system that connects with the airport) or within linked transport hubs, meaning that passengers can turn up to the airport only carrying hassle-free hand luggage.

Longer term, baggage pickups will become even more flexible once airports partner with established courier companies to collect bags from wherever the passenger needs it, delivered in whatever mode is most appropriate.

Mobile app technology and real-time monitoring and communications means that customers will be able to get real-time positioning on where their baggage is, which will also have the benefit of improving lost-luggage reporting and processing.

There are still issues to overcome – security of baggage when it is picked-up at hotels, for example, and the laws governing security checks with biometrics currently differ from country to country – but there is a clear trend towards separating baggage and passengers.

## Less screen-time

Security screening is another area that will take advantage of biometric technology to realize efficiency benefits. Already, airports such as Dubai Airport are using face-scanning to allow for a more transparent security process. Using a combination of sensor techniques, passengers are scanned as they pass, speeding up the process and improving the passenger experience. These tunnels can contain a number of different screening technologies – body scanners, metal detectors and liquid detection – and more technologies will be integrated in the future. The IATA estimates that biometrics will reduce waiting times at security gates by 40%.

As the systems become more sophisticated, security and immigration can be linked, especially when the underlying passenger databases for the airport and immigration systems are integrated. The industry is already working on the process of integrating all data in an airport into a single database, structured in a standard way and used much more efficiently. The same biometric and screening technology will make it much easier to board the plane at the departure gate.

This also benefits passengers when they arrive at their destination, where biometrics and common databases will lead to a massive reduction in immigration bureaucracy. Baggage return

will also be made more efficient through biometrics and bag-tracking technology, including onward delivery of baggage to the passenger's final destination.

## The Process Problem

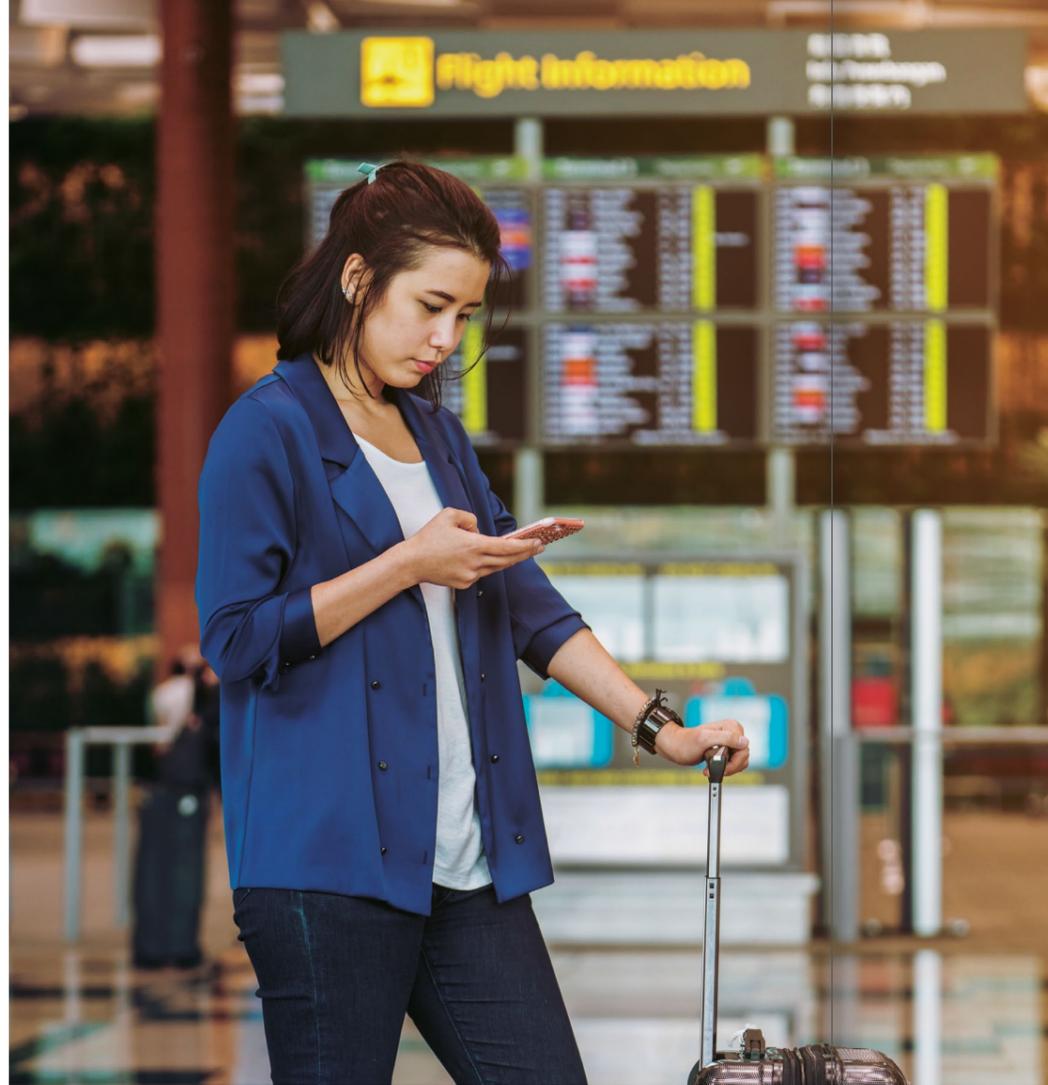
These solutions are not without their challenges. Legislation in different countries will need to be coordinated to allow for seamless security and immigration checks, and a degree of pre-screening and trusted traveller programmes will need to be implemented in order to speed up the process. However, these are largely process improvements than significant technological challenges, and there is no doubt that airports will continue to rely on digitization for their aviation operations.

Digitization will help passengers too. Digital wayfinding will become commonplace, with handheld devices containing real-time flight information, departure gate information, landing cards, wayfinding and baggage collection. Automated gate systems will also make use of these digital wayfinding apps, helping to improve the use of valuable airport space and reduce personnel costs – while also improving the passenger experience.

The technology to do all of this exists today, but the challenge for its use is one of real-time trusted information. After all, the only way that passengers will truly relax at an airport is if they know that the information they are receiving is trustworthy – and that the steps they need to take to reach their final destination will be friction free. But despite today's mixed results in delivering this vision, it will be a reality sooner rather than later.

*“The problem with airports is that we go there when we need to catch a plane - and because it’s so difficult to find the way to the gate, we tend not to look around at our surroundings.”*

**Alain de Botton**  
Philosopher and Author



## Mobility matters

One of the biggest challenges passengers have with airports has to do with mobility - getting to the airport, travelling around the airport, and then finding their way to their final destination after landing. This is especially true now that airports are getting larger. However, airports have the opportunity over the next 20 years to fundamentally transform this passenger pain point - and they will need to, because passengers will actively seek out airports with the fastest, easiest and cheapest transport routes.

This should not be surprising, as it is only a continuation of the trend towards digitization and convenience that has revolutionized - and upended - the world of retail. It’s clear that airports must continue to work hard on being as efficient and delay free as possible.

### “To the airport, driver”

Within the airport environment, automated vehicle technology is already being embraced to help move passengers to and from car parks and terminal buildings, but this trend will continue apace as the underlying technology becomes mass market and even more efficient.

By 2037, mass electrification of the world’s vehicular transport infrastructure will have become a reality, and airports can lead the way on promoting the benefits of automated and driverless vehicles as a way of alleviating congestion around the terminal buildings and the airport estate.

### Parking planning

There are other automation drivers too. As airports get bigger, the distance between terminals and parking lots is increasing - with journeys of several kilometres or more from long-term parking now commonplace. This does nothing to improve customer satisfaction survey results. But by using self-driving autonomous vehicles - as used at Heathrow T5 in the UK, and several other airports around the world - or driverless light rail solutions, airports can give passengers an alternative to the near-ubiquitous irregular or unreliable shuttle bus solution.

Parking will change in other ways too over the next 20 years. When cars incorporate self-driving technology, they will be able to park themselves in more remote locations, separating airport infrastructure even further from parking infrastructure. And

because of the in-built precision of self-driving vehicles, parking spaces can be smaller, freeing up more valuable land for other uses. This shift in the technology of parking may well create greater bottlenecks closer to the airport terminal buildings, as the demand for ‘Kiss and Fly’ increases. Passenger drop-off zones will therefore need to be larger, and as close to the terminal as possible.

### Transit as a competitive advantage

Fundamentally, airports will need to embrace a much more integrated approach to mobility planning in and around their estate than is currently the case, as each mobility transition will impact upon the other. Airports will also need to act as a catalyst by creating integrated transport master plans with their feeder cities.

One of the most important principles underpinning these masterplans is the need to integrate airport infrastructure with as many modes of transport as are economically and financially feasible. This may mean taking a long-sighted approach to integrating airports with high-speed rail systems, for example, which will help displace a number of short-haul flight options onto more efficient high-speed rail networks. Airports can therefore proactively choose to cooperate - rather than compete - with high-speed rail in the provision of short to medium distance travel services, before they’re forced to, either by regulation or by carbon emissions reduction targets.

Light rail connections are also good additions to the mobility systems surrounding airports. In cases such as Heathrow in the UK or Schiphol in the Netherlands, the travel time savings en route to the airports make a very good business case for dedicated airport transit elsewhere.

There’s another reason that airports should embrace multi-modal transport services - customers expect choice. By considering travel to and from the airport through the lens of the customer, not just through the lens of capital cost efficiency, airports can proactively try to eliminate single points of failure in the airport transport environment. This will be a crucial step forward.

### Optimized travel

There is one more trend that should have a transformative impact on transport to and from airports: Mobility as a Service (MaaS). MaaS is currently being piloted in a business district in Amsterdam in the Netherlands, and uses an integrated approach to sustainable transport by combining multiple modes of transport into a single delivery platform - in this case an app. In the same way that Uber or Lyft provides access to drivers and cars where and when you want them, the Mobility as a Service trial enables users to plan journeys, buy travel tickets, reserve car shares or bikes, and pay for each instance of transport with a single seamless payment system. The ultimate aim is to try to change travel behaviour and shift people towards more sustainable modes of transport. In the not too distant future, all available transport options will be digitally connected into one seamless experience on one app.

Within the airport context, Mobility as a Service would no doubt improve the passenger experience when travelling to and from the terminal.

## Customer-centric

Given the projected growth in flight numbers, airports will have to invest in expanding their physical infrastructure. In a ‘business as usual’ approach to expansion, waiting areas will need to be expanded, along with baggage handling infrastructure and ticket processing in order to overcome congestion within the terminal building. But a business as usual approach is no longer enough.

Nor is innovation, efficiency or even sustainability in airport design. To become the airport of choice, airport operators must also integrate the needs of customers into their terminal design decisions.

This is also a hard-nosed business decision. By creating spaces that passengers enjoy being in, airport operators can give themselves a fighting chance of overturning the trend of declining revenues from non-aviation activities.

### Handbags and gladrags

There are a number of reasons for this decline. With duty-free and luxury goods outlets selling the same things the world over, many passengers feel unexcited by the range of goods on offer. Also, the demographics of regular flyers are shifting towards those with less disposable income, meaning fewer retail purchases within airports. Revenues from parking and car rental services are also falling as services such as Uber and Lyft displace those formerly reliable sources of revenue.

This revenue shortfall is likely to continue, and is happening at a time when airports are also facing another cash squeeze.

The ongoing consolidation in the airline industry – creating ever-larger airline carriers – has led to a significant reduction in landing fees. The airlines are taking advantage of their greater buying power to drive down fees and airport operators are not in a position to say no. They need a new approach.

### Design as competitive advantage

There are a small but growing number of airports – led by Changi Airport in Singapore – that are showing the way in terminal design. They’re creating better passenger experiences by providing features such as quiet zones, sleep pods and multi-generational entertainment areas – suitable for young and old alike – which could have the effect of reducing passenger stress.

Changi’s new Jewel complex brings Singapore’s “City in a garden” concept to life in a vast indoor garden, retail, hotel and leisure destination just outside the airport’s terminal building. It’s a destination that airport passengers and local citizens alike can enjoy, including the 40-meter high indoor waterfall and indoor tropical rain forest environment.

Other airports – Orlando, Doha, Indianapolis, for example – talk of ‘Town Squares’ and ‘Civic Plazas’, and are unashamedly focusing on leisure and entertainment. Doha, in particular, has created a cultural experience based around major pieces of art – both bought and specially commissioned. These airports want to create a sense of place, where it’s pleasant to stay, creating ‘experiences’ for passengers that include arts and culture, music, movies, fine dining, hotels and digital entertainment. When done correctly, this design approach should create a virtuous circle, where better passenger experiences provide a greater opportunity to relax, which also bring about a greater willingness to spend.



Singapore’s “City in a garden”

### Finding your way

All of these ‘experiential’ design features would be undermined if the processes guiding passengers to their planes weren’t similarly pleasurable. This is where digital technology can genuinely bring benefits to terminal design. By integrating in-terminal GPS and making use of augmented reality and automated gate-wayfinding, passengers will begin to trust that they are going where they need to in a timely manner.

*“It can hardly be a coincidence that no language on earth has ever produced the expression, ‘As pretty as an airport.’”*

**Douglas Adams**  
(The Long Dark Tea-Time of the Soul)

## Serious about sustainability

The aviation industry is under pressure to play a full role in the global effort to reduce CO2 emissions. From 2021 until 2026, the sector will be encouraged to voluntarily implement the ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), with all member States expected to be on-board from 2027 through to 2035. And following the COP21 meeting in Paris in 2015, an initial target was set for creating 50 carbon neutral airports around the world by 2030, a target which was increased in 2017 to 100.

Together with the airport specific requirements coming from the UN's Sustainable Development Goals, it's clear that the obligations and regulatory pressures on the global aviation industry will only increase as the world confronts the climate change challenge.

### Global impact, local pressure

As well as these global initiatives, airports are under increasing pressure from more stringent local operating environments, where licenses to operate – and passenger preferences – are increasingly based upon meeting very local sustainability targets. These include local air quality, surface access, climate change, use of natural resources, noise impact and waste management.

There is also a dual focus by airport operators on reducing their energy costs and increasing the use of renewable sources within their energy supplies. Terminal buildings are by far an airport's greatest energy consuming assets, with the greatest energy consuming elements within being baggage handling, lights, cooling and IT infrastructure. New-build airports have the upper hand in getting the energy

equation right from day one, but long-established airports also have significant opportunities to reduce their energy loads. Given the increasing demand for electricity, airports are introducing more resilient utility operations through improved energy storage technology, smart metering and smart grids to build resilience against major outages.

In Australia, for example, Brisbane Airport has installed a major rooftop solar system that includes 22,000 solar panels across a 36,000 square meter area spread across six sites. And Cochin International Airport in the Indian state of Kerala became the first airport in the world to be entirely powered by solar energy. 46,000 on-site solar panels produce 12 megawatts of energy, enabling it to power all of the airport's operations from renewable sources. Initiatives such as these can give airports energy independence as well as showcasing sustainability credentials.

### Four to the floor

There are at least four major opportunities for improving the overall sustainability in the airport arena. Within pre-flight transport, emissions from cars driving to and from the airport can be mitigated by encouraging car sharing, electric vehicle use, building an electric vehicle charging infrastructure, and encouraging multi-modal public transport. Within landside and terminal operations, energy independence can be improved by installing major solar panning arrays.

Airside operations can improve congestion issues and wasted fuel on the ground by improving air traffic control operations and electrifying the taxiing process and implementing smart pavement. While flying, problems of aircraft noise, extreme carbon emissions and kerosene composition can be mitigated by using more efficient aircraft, more efficient flight routing, and finding more sustainable fuel sources.

### Eyes on the sky

Longer term, improvements in aircraft engine technology – including hybrid electric propulsion systems being developed by NASA, and similar alternatives being developed by a consortium including Airbus, Siemens and Rolls-Royce – will improve carbon emissions, fuel efficiency and noise levels in commercial aircraft. Test flights are likely to take place from 2020.

Flights will also become much more efficient with the continued evolution of air traffic control, which is transitioning to an era of air traffic management. The combination of high definition cameras and improvements in remote sensing make it possible to use predictive technologies within air traffic management that will improve operations and overall safety. Already, some airports – including City Airport in London – have implemented

a virtual air traffic control room which relies on multiple cameras to provide a 360 degree view of the airport and which can overlay radar information on-screen. The audio visual information is piped to a control room 120 miles away from the airport, where air traffic controllers can zoom in to get a much more comprehensive – and more detailed – view on the skies above.



*“When you realize that aviation, if it were a country, would be the 21st largest economy in the world, supporting 62.7 million jobs and nearly three trillion dollars in economic impact, you really see the scale of air transport.”*

**Michael Gill**  
Executive Director of ATAG

## Making it happen

Amid all of the challenges facing airports today, it's clear that airport operators will need to carefully consider how they manage their existing business, and how they plan for the future anticipated growth in passenger numbers.

Infrastructure upgrades and expansion programmes will need to be managed as efficiently as possible – and existing assets managed more effectively – while revenue gaps from 'business as usual' activities such as retail and landing fees will need to be filled by airports looking afresh at becoming customer champions, and airports of choice.

If properly designed and the latest digital infrastructure is leveraged, airports are in a unique position to not only satisfy the world's growing demand for flying, but also deliver significant economic benefits in the form of tourism, trade and business services.

The potential of airports as an asset is significant, but they can also become a hub of innovation and opportunity as well as a gateway to the world.

By becoming an airport city – or 'aerotropolis' – they can bring far-greater economic and social benefits to a region than if they were to act in isolation. We owe it to our future generations to get the planning and design right.



Schiphol Airport

# About Arcadis

Arcadis is the leading global Design & Consultancy firm for natural and built assets. Applying our deep market sector insights and collective design, consultancy, engineering, project and management services we work in partnership with our clients to deliver exceptional and sustainable outcomes throughout the lifecycle of their natural and built assets. We are 27,000 people, active in over 70 countries that generate €3.3 billion in revenues. We support UN-Habitat with knowledge and expertise to improve the quality of life in rapidly growing cities around the world.



**Nick Hutchinson**  
Global Leader - Airport Solutions



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