PASSENGER
TERMINAL*WORLD*

Civil unrest

HOW AIRPORTS IN HONG KONG AND ECUADOR COPED WHEN THEY BECAME SCENES OF MAJOR PROTESTS

Passenger Terminal Expo
All you need to know ahead of the event in Paris, France, March 31 to April 2

Water conservation
How airports are conserving their most valuable resource

Green construction
The latest eco-friendly airport building methods

Sustainable design goes further than just using the latest eco-friendly materials in a new terminal. Leading architects, engineers and airport executives discuss how airports can achieve a truly sustainable future

Call of nature

International Departures

Grimshaw's concept design for London Heathrow Airport expansion (Image: Grimshaw)

T ackling climate change is a task that governments and businesses around the globe are increasingly being challenged to address. If you look at the aviation sector in particular and recent airport developments, it is it almost certain that environmentally friendly design features heavily in a bid to reduce their impact on the climate.

At this year's Passenger Terminal Conference in Paris, France, a number of experts from airports and businesses around the world will take to the stage in a panel discussion to look at the most effective approaches to achieving sustainable aviation, with a focus on how to overcome the main barriers and challenges in green airport design.

Panel moderator, Dr Paul Toyne, sustainability practice leader at Grimshaw, will draw from examples on project work and look at how an environmentally friendly approach has been taken for the expansion of Heathrow Airport. Toyne says, "While the transition to a fully decarbonized aviation sector will take longer than other sectors due to the industry needing more time to develop and implement energy-efficient aircraft designs and alternative fuels, it is imperative that we design environmentally friendly infrastructure now. This will enable airport owners to dramatically reduce the carbon footprint of their estate and operations sooner and ensure they are equipped to accommodate the significant innovations in aviation that are yet to arrive."

Toyne will be joined on stage by experts from Bangalore International Airport Limited (BIAL) and Heathrow, and environmental design consultant Atelier Ten. Representing BIAL will be Satyaki Raghunath, chief strategy and development officer, who believes that now is the time to act when it comes to going green. "It is becoming increasingly

> We must also ensure that airports are **designed with the unavoidable impacts of climate change** in mind
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> Dr Paul Toyne, Grimshaw

TOP
Grimshaw has been selected to develop the £14bn (US$18bn) expansion plan for Heathrow (Image: Grimshaw)

apparent that human activity is creating a negative impact on the environment," he says. "If we don't act quickly, there is a high probability that we won't leave much for our future generations. We need to focus not just on more environmentally friendly designs, but also a much more sustainable and less consumer-driven lifestyle."

Embracing sustainability

For Grimshaw's Toyne, sustainable design is about more than just using the most environmentally friendly materials. It is about developing an airport that is set up to deal with future changes in transportation. "By designing future-proofed airports that can properly house and facilitate new types of aircraft, and fulfill their fueling requirements, we will ensure that airports retain their capacity to fully integrate transformations in technology in the most environmentally conscious way," he says. "We must also ensure that airports are designed with the unavoidable impacts of climate change in mind, and are resilient to the future stresses and shocks of extreme weather."

Grimshaw, which is part of an integrated design team for London Heathrow's expansion, has long had a focus on sustainability. Last year, its new chairman, Andrew Whalley, made a bold statement when he announced the practice will start the new decade with net zero carbon operations across its international studios, and all of its design work will be net zero carbon ready by 2030.

Toyne explains more: "There are a number of initiatives already underway at Heathrow working concurrently to achieve the airport's ambitious sustainability targets. These proposals include extensive improvements to local communities and habitats, a target to operate zero-carbon
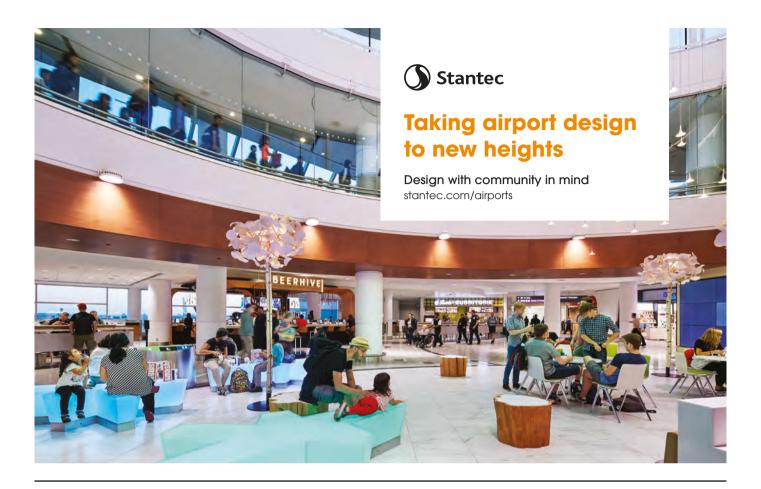
What more can be done to reduce emissions in aviation?

While new and existing airports implement the latest eco-friendly designs, more still needs to be done to reduce the aviation sector's impact on the environment, according to Paul Toyne from Grimshaw and Satyaki Raghunath from BIAL.

Toyne says, "It is important to acknowledge that carbon emissions from the aviation sector contribute up to 3% of total global emissions, a figure that is set to double within the next 30 years. Responsible airport owners have set ambitious targets for carbon neutrality, and as architects we must support them, and the wider aviation sector, to deliver

a net-zero-carbon agenda for future infrastructure, and drive research and innovation in alternative fuels and energy efficient aircraft."

Raghunath, meanwhile, believes communication is the key: "I think the aviation sector has done a lot of work over the last decade to reduce emissions within the industry, but we could certainly do more. I think we need to talk to each other a lot more and truly work toward common goals where profit is not the only motive. We need to have a sense of purpose as we deliver these goals. That would automatically improve our sustainability efforts."

> We are focused on **achieving zero landfills** over the next two years

Satyaki Raghunath, BIAL

infrastructure by 2050, improvements to public transport to double the number of its users, a 25% reduction in embodied carbon through maximizing recycled and low-carbon materials, zero waste and carbon offsetting, and minimizing the operational energy demands of the airport's facilities."

Meanwhile in India, BIAL's Kempegowda is one of the world's leading airports for sustainability. The airport has several initiatives that are focused on sustainable growth, including renewable energy sources to power over 70% of its needs across the campus, being water positive, and developing its own solid waste management facility.

"Terminal 2, BIAL's flagship project scheduled to be commissioned in 2021, is based on naturally available and organic materials – across large areas," explains Raghunath. "In addition, we have encouraged the use of plastic waste for the development of roads and done away with single-use plastic across our campus. We have also used LED lighting for airfield ground lighting. We are focused on achieving zero landfills over the next two years, and finally, we have recently renewed our ACI carbon accreditation certificate."

Key challenges

According to Grimshaw's Toyne, one of the main challenges concerned with environmentally friendly design is perception of cost. "There is a need to overcome the perception that sustainable design results in higher costs," he explains. "It is in fact often the case that low-carbon solutions mean lower costs, and part of our role as architects is to communicate to clients and partners how an efficient approach to design and build that reduces embodied and operational carbon can have both short- and long-term cost benefits. While it is true that certain lower energy initiatives do require initial

financial investments to implement them, these can be offset by reduced costs over time."

Perception is just one of the challenges facing architects and engineers when attempting to make new airport plans as environmentally friendly as possible. Another challenge, according to global engineering firm, Arora Engineers, is what mechanical practice lead, David Marsh, refers to as "monumentality in airport terminal design".

Marsh explains more: "Modern airport terminals are following the precedent of late 19th century railroad terminals and becoming 'temples of transportation'. Each community wants its local airport to be a suitable gateway expressing their civic pride to the world. High cathedral ceilings and extensive windows can, for example, potentially be sources of increased energy use. However, every problem also presents an opportunity for sustainable design.

"By implementing state-of-the-art sustainable design techniques, a seemingly inefficient building feature can be turned into a means of energy reduction. Large windows allow for increased daylighting possibilities. High ceilings allow innovative cooling air distribution methods to be employed to reduce energy in many cases below what might be possible in a more traditional space. Human ingenuity can overcome any problem to provide for a more sustainable future," Marsh adds.

Like Grimshaw, Arora has worked on a number of projects in recent months that have had sustainable construction and design at the core. "We were recently involved with a large-scale terminal modernization program in the New England region of the USA," says Marsh.

"The project included the expansion of an existing terminal and the addition of a visually stunning cathedral-style grand hall passenger concourse. Normally, high ceilings are viewed as energy problematic, as supplying air-conditioning and ventilation air in a high ceiling space often requires more supply and outdoor air to properly cool the increased volume and provide sufficient fresh air to the people many feet below. By means of a displacement ventilation system, low-velocity tempered air will instead be supplied at occupant level and the air in the unoccupied space above the people allowed to thermally stratify. Computer simulations indicate this arrangement will result in a reduction in the supply of fresh outdoor air by 33% compared with a conventional system. This will yield a US$300,000 (20%) annual energy cost reduction."

Passenger Terminal Conference

PANEL DISCUSSION: WHAT DOES THE SUSTAINABLE AIRPORT OF THE FUTURE LOOK LIKE?

Speakers: Satyaki Raghunath, chief strategy and development officer, Bangalore International;
• George Davies, head of expansion sustainability and environment, Heathrow Airport;
• Patrick Bellew, founding director, Atelier Ten;
• Dr Paul Toyne (panel moderator), sustainability practice leader, Grimshaw.
Session: Environment and Sustainability
When: Tuesday, March 31

ABOVE
The Heathrow expansion will include new terminal facilities, sheltered beneath a large, undulating glass roof (Image: Grimshaw)

Future sustainable design

The next few years certainly hold a lot of promise for greener solutions as authorities around the world continue to put pressure on industry and suppliers to develop new eco technologies. For BIAL's Raghunath, who highlights Heathrow, Stockholm Arlanda, Zurich and Seattle-Tacoma as four airports leading the way in sustainable design, there are a number of technologies that are "likely to yield tremendous benefits in the future".

He explains, "Some of them include advanced materials developed from local resources and the move to hydrogen cells and electric vehicles, coupled with ridesharing. The development of digital technologies, including IoT-driven energy deployment, will reduce energy consumption. Digital twins/3D printing will significantly reduce the need for paper and cut development and delivery times, thereby reducing energy."

Meanwhile, Grimshaw's Toyne believes that the industry needs to focus more on using, where possible, materials with lower embodied carbon. "We should also seek more opportunities to integrate alternative materials – such as timber – recycled materials, and locally available materials. There are already decarbonization pathways being

> There will be **opportunities for efficiency improvements** that will reverberate across the entire site
>
> David Marsh, Arora Engineers

traced for construction materials, with research exploring low-carbon production, such as the use of hydrogen in smelting steel, or Heathrow's own development of low-carbon concrete solutions. By continuing to monitor these innovations, we will be better placed to specify the use of materials as they become available."

For Arora's Marsh, it is the airport's utility plants that hold of lot of promise in the future for sustainability improvements. "Many airports today still have central utility plants which use older vintage equipment that may not be as efficient as more modern approaches," he says. "The need to connect new buildings to these legacy central plants can put an upper limit on achievable energy/carbon reductions due to the central plant limitations. Over time, as these central plants reach the end of their expected lifespans and need replacement, there will be opportunities for efficiency improvements that will reverberate across the entire site."

Aside from on-airport processes and materials, the increased use of eco-friendly surface access methods could also make a big contribution to the reduction of emissions. "The electrification of travel and introduction of autonomous systems will allow airport users to access and travel to airports in more energy-efficient manners," says Toyne. "Investment in airport rail links will also encourage public transport use, reducing emissions from travel to and from the airport.

"Heathrow has committed to there being no more cars on the road as a result of its expansion, and this will be achieved through a design that prioritizes public transportation and integrates all modes into pedestrianized and accessible passenger environments," he adds. "Plans have ensured that all new parking will be on the airport perimeter, reducing congestion and time required to arrive in private cars, which in turn will lower emissions." ■

Arora Engineers takes on asset management

Alongside its work in sustainable design, Arora Engineers is also working alongside Kansas City International Airport to develop a new asset management program for the existing airport and its new terminal, which is set to open in 2023. Manik Arora, president and CEO of Arora Engineers, will be joined by Ian Redhead, deputy director of aviation, Kansas City Missouri Aviation Department, at the upcoming Passenger Terminal Expo and Conference to discuss the new program and its ability to monitor and manage the full lifecycle of the airport's enterprise assets, such as facilities, communications, transportation, production and infrastructure in the new maintenance facility building. The presentation will be held during the Facilities Maintenance and Management session on Thursday, April 2.