Airports and harbours prepare to slash emissions as the greening of transport accelerates

December 2 2022, by Michael Allan

Airports and seaports are preparing the critical infrastructure needed to reduce emissions from transport. Credit: Jan Rosolino via Unsplash

Ports for planes and ships are gearing up for the era of sustainable fuels

and renewable energy.

If the European Union is to meet its net-zero targets and become a climate-neutral economy by 2050, the transport industry needs to decarbonise—and quickly.

International aviation and maritime transport could account for almost 40% of greenhouse gas (GHG) emissions by mid-century. Due to increasing demand for freight shipping and air travel, GHG discharges from ships and planes in particular continue to rise.

In the push to mitigate human-made climate change, both industries are looking to new low-carbon energy sources such as hydrogen and electrification.

While much attention is paid to cleaner planes, boats and ships being developed, perhaps an even bigger industrial challenge is creating the infrastructure that ports and airports will need to produce, store and pump the low-emission fuels.

Airports have much to do in order to prepare for this coming era, according to Fokko Kroesen, who is coordinating the EU-funded TULIPS project exploring ways to reduce emissions at airports.

New fuels

Aircraft manufacturers are investing in new fuel and propulsion technologies, but they will also expect airports to be ready to deliver these fuels, according to Kroesen, who is senior advisor on sustainability at the Royal Schiphol Group, which operates Schiphol and other airports in the Netherlands. The whole system will be very different from current kerosene-based provisions, he said.

Through demonstrator projects at four airports, TULIPS's research into innovative and sustainable airports will put new green technologies to the test. A roadmap to 2030 will then show airports the best ways to advance the low-carbon transition.

Research on supplying energy to aircraft is going in two directions, according to Kroesen. The first is sustainable aviation fuels produced from renewable feedstocks such as biomass, instead of petroleum. The second is energy supply for new aircraft that will be powered by technologies including batteries and hydrogen.

Because sustainable aviation fuels, or blended sustainable and conventional jet fuel, can be used in current planes, they can bridge the gap between today's aircraft and those of the future that run on completely different sources of energy. This is particularly important for providing lower carbon alternatives for intercontinental flights, as novel aircraft powered by hydrogen or batteries are likely to be able to travel only shorter distances initially.

It could take a long time to develop alternative propulsion methods for intercontinental flights, according to Kroesen.

'Therefore, we expect that sustainable aviation fuels are really needed to enable net zero-emission flights,' he said.

Also in the future, most airport ground-support vehicles will run on batteries. Some heavy equipment, such as the tractors used to tow aircraft around the tarmac, may even need to be powered by hydrogen as a result of their high energy demands.

Kroesen says this poses an infrastructure challenge for airports. At Schiphol in Amsterdam, he said, 'there is a growing demand for electricity and the current infrastructure is not sufficient to enable this.'

Greener airports

As a result, the airport is investing in solar panels and other forms of renewable energy. The long-term aim is for the airport to produce more energy than it uses, said Kroesen. Developing a smart energy hub will help optimise the green electricity supply to deal with the competing demands from the various applications.

Airports will also need to ensure reliable supplies of sustainable aviation fuels and hydrogen. TULIPS is exploring not only how airports can generate these fuels but also how new industries can be encouraged to produce and supply them.

Sustainable aviation fuels are generally produced from biomass. They have a similar chemical profile to conventional jet fuel produced from petroleum. While this means they can use the same storage and refuelling infrastructure at the airport, it doesn't mean that switching is simple.

TULIPS is looking at the cost and practicalities of sustainable aviation fuel, and how to develop effective incentives to stimulate its production and use. Ideally, production would take place near the airport.

'The main challenge we see for sustainable aviation fuels is the scaling up in a sustainable way—and the limits of available production technologies and resources, or feedstocks, to produce these sustainable fuels,' said Kroesen.

Beyond plants and plant waste, researchers are looking to create sustainable fuels from electricity, hydrogen and carbon captured from the air.

'That is very attractive because it is a type of circularity,' Kroesen said.

'We emit carbon dioxide, but immediately after emitting we will take it out of the air and, together with hydrogen, we can build new synthetic kerosene out of it.'

Unlike sustainable aviation fuel, hydrogen will require a whole new infrastructure for delivery, storage and refuelling. It cannot simply use the conventional jet fuel infrastructure.

Hydrogen is created when it is separated from water using electricity. If the energy used for this electrolysis comes from renewable sources, the resulting hydrogen is considered a green energy source. It will be possible to produce hydrogen at airports and in the locality in so-called hydrogen valleys—economic areas that produce locally consumed green hydrogen.

In the longer term, however, Kroesen says that such local production will not be enough to meet demand. This is due to a combination of factors, including the limited availability and cost of green electricity in some locations. This energy source will also face competing demands from other industries.

'We will probably see a mix of locally produced and also imported hydrogen, from areas that are richer in energy and poorer in demand,' Kroesen said.

Smart ports

Arne-Jan Polman, at the Port of Rotterdam, said that preparing ports for the potential fuel mixes used by ships in the future is also a complex process.

Europe's largest seaport, Rotterdam is seeking to become carbon neutral by 2050. The port set up the EU-funded MAGPIE project to create a

masterplan outline of how Rotterdam and its partner ports will become green by mid-century.

The port will transform itself into a smart green port by improving current energy systems, developing a new greener energy system, switching to non-petroleum fuels and raw materials, and encouraging a shift to sustainable freight transport.

The project's 45 partners intend to create an energy masterplan as inspiration for any of Europe's maritime and inland ports that want to go green.

When it comes to fuels, MAGPIE is focusing on electricity, ammonia, hydrogen and a biofuel version of liquefied natural gas (bio-LNG).

'We think that these four energy carriers will play a major role in the future,' Polman said. The port also sees an important role for methanol as a green fuel.

As with TULIPS, a large part of this is encouraging new energy supply chains while demonstrating technologies for creating biofuels and exploring fuel infrastructure and supply needs.

Demonstrations by the project will include port-based bio-LNG production, ways proactively to manage power demand, ammonia bunkering (delivering the fuel to ships) and an offshore charging buoy.

Smart energy

Polman says that ports need to change how they see themselves.

'Not any more the traditional landlord role, but more the developer of our surroundings, the director of the new energy landscape, which means

we are sort of facilitating the whole smart energy transition process,' he said. 'What we need to do is make sure the conditions are there for companies to invest in our port area.'

As with airports, there are other vehicles besides ships that need to plug into the energy supply. These are mainly short-shipping barges, trains and trucks that transport goods to and from the Port of Rotterdam from smaller regional hubs.

MAGPIE will need to try to predict the future energy mix and work out how to prepare for it. But it is also just about getting these different fuels to a point of technological maturity where they can be used and are available for anyone that needs them, according to Polman.

After that, it is up to industry and the market to decide which direction they want to go and what to invest in. The ports just need to be ready.

The port will need to speak to industry to see what it needs while making sure it attracts the right partners to meet its long-term energy goals, rather than short-term economic profitability. But it must also liaise with governmental bodies—from the EU to local municipalities—to develop permits, regulations and subsidies to stimulate industry growth.

'We need to build the landscape,' Polman said.

Research in this article was funded by the EU. This material was originally published in *Horizon*, the EU Research and Innovation Magazine.

Provided by Horizon: The EU Research & Innovation Magazine

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