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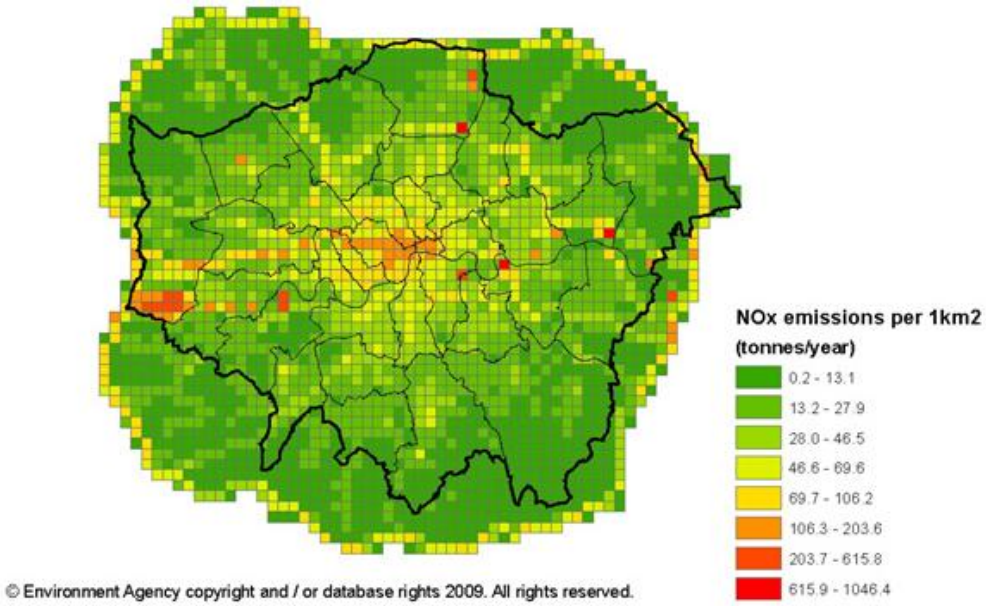
Fuel Cells at Airports: A Good Idea Takes Off

21 NOVEMBER 2012



Airports are keystones of global commerce, but they are also emissions hotspots. In the 2006 NOx map of London shown above (© Environment Agency, 2009), Heathrow Airport (LHR) is instantly recognisable in the far west, with the greatest emissions in the whole of Greater London. Unfortunately there is no easy way to substantially reduce these emissions, as they are in large part a direct product of the many planes taking off and landing – and we are still some way from realising a suitable non-polluting fuel capable of launching a 350-tonne tube of metal 30,000 feet into the sky. To try and abate this, airports are keen to decarbonise the surrounding infrastructure that supports the planes and their passengers as much as they can.

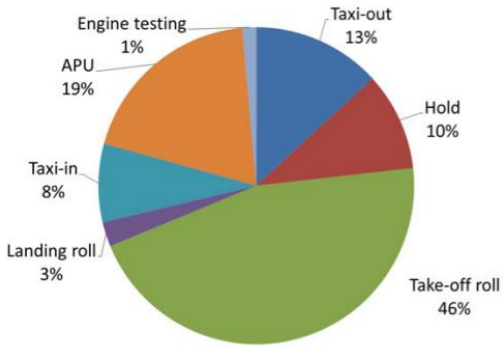
At Heathrow, 37% of the total NOx emissions come from airside and landside vehicle traffic. This ground support equipment (GSE) – the tow tractors and other vehicles that service the aircraft before and after flight – is a good starting point for lowering emissions and is one that many airports are actively pursuing. Batteries have become a popular choice here but they are not without their drawbacks: range is limited, the units are heavy and the battery swapping/charging infrastructure is large and slow. Fuel cells can offer the same displacement benefits here as they have done in the materials handling vehicle (MHV) market: longer runtimes, lighter systems, and compact and fast refuelling infrastructure. At the beginning of the month, fuel cell forklift specialist Plug Power received a $2.5 million award from the US Department of Energy (DOE) to retrofit fifteen electric tow tractors with hydrogen-powered fuel cells for use at two of FedEx's domestic airports in Tennessee and California. Plug Power has experienced rapid success in the MHV market, which was stimulated by capital subsidies made available through the 2009 American Recovery and Reinvestment Act (ARRA). Moving into the GSE market is an obvious choice for the company.

The introduction of hydrogen delivery to an airport and the installation of a refuelling station for GSE opens the door for further propagation of fuel cell equipment at the airport, and ergo further emissions reductions. Internal combustion engine (ICE) shuttle buses between terminals and car parks could be modified to run on hydrogen or replaced with fuel cell buses. In the longer term, once FCEV have widely commercialised, hydrogen could be sold to drivers.

These notions are most easily realised when constructing new airports, and Germany's new Berlin Brandenberg airport (BER) is a shining example. As part of the construction of the airport, German renewable energy contractor Enertrag led a grouping that included TOTAL Germany, Vattenfall and Deutsche Bahn in building a wind–hydrogen hybrid power plant near the town of Prenzlau Uckermark. During periods of excess wind, the three 2 MW wind plants generate carbon-dioxide-free hydrogen *via* electrolysis. This is stored and can be used at the site in hydrogen–biogas combined heat and power (CHP) plants or piped to BER, where TOTAL has constructed a hydrogen refuelling station on a forecourt that also includes CNG refuelling, conventional refuelling, and battery vehicle charging points (diagram). Elsewhere in Germany, a containerised hydrogen refuelling station was installed at Hamburg Airport (HAM) in 2007 to help evaluate the use of two fuel cell tow tractors and a hydrogen internal combustion engine (HICE) people carrier – an early indication of interest in hydrogen at airports. Containerised refuelling stations are a great way to allow airports to test hydrogen solutions before fully implementing them; the first organisation to take part in UK electrolyser manufacturer ITM Power's Hydrogen On-Site Trials was London Stansted Airport (STN).

Returning to Heathrow, Air Products installed a publicly-accessible hydrogen refuelling station in July 2012 to support a fleet of five fuel cell electric taxis that were used to ferry dignitaries between the airport and the Olympic Village during the Olympic and Paralympic Games. The airport is committed to trialling low-carbon vehicles and it has been suggested that the same hydrogen station will be used to trial fuel cell powered GSE in the near future.

Attention is also turning to novel ways to reduce emissions from the aircraft themselves. When looking at Heathrow's estimated ground level emissions from aircraft in 2010 (right), APU (the auxiliary power unit, used to start the jet engines and provide hotel load) is the second largest culprit. The use of fuel cells as APU is being investigated in several projects – most recently Boeing has been testing a regenerative fuel cell system throughout September 2012 on an 'ecoDemonstrator' 737-800 and rival Airbus is working with Germany's DLR to install a 90 kW fuel cell APU system in an A320. This follows successful tests last year of using fuel cells to power electric nose wheels for taxiing.



Hydrogen stations have also been installed in several other airports, including two in Canada – the hydrogen station at Vancouver International Airport (YVR) is one of a network used to support Whistler's famous fuel cell bus fleet – and many more airports, such as Oslo (OSL), are undertaking feasibility studies for the implementation of hydrogen and fuel cells.

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