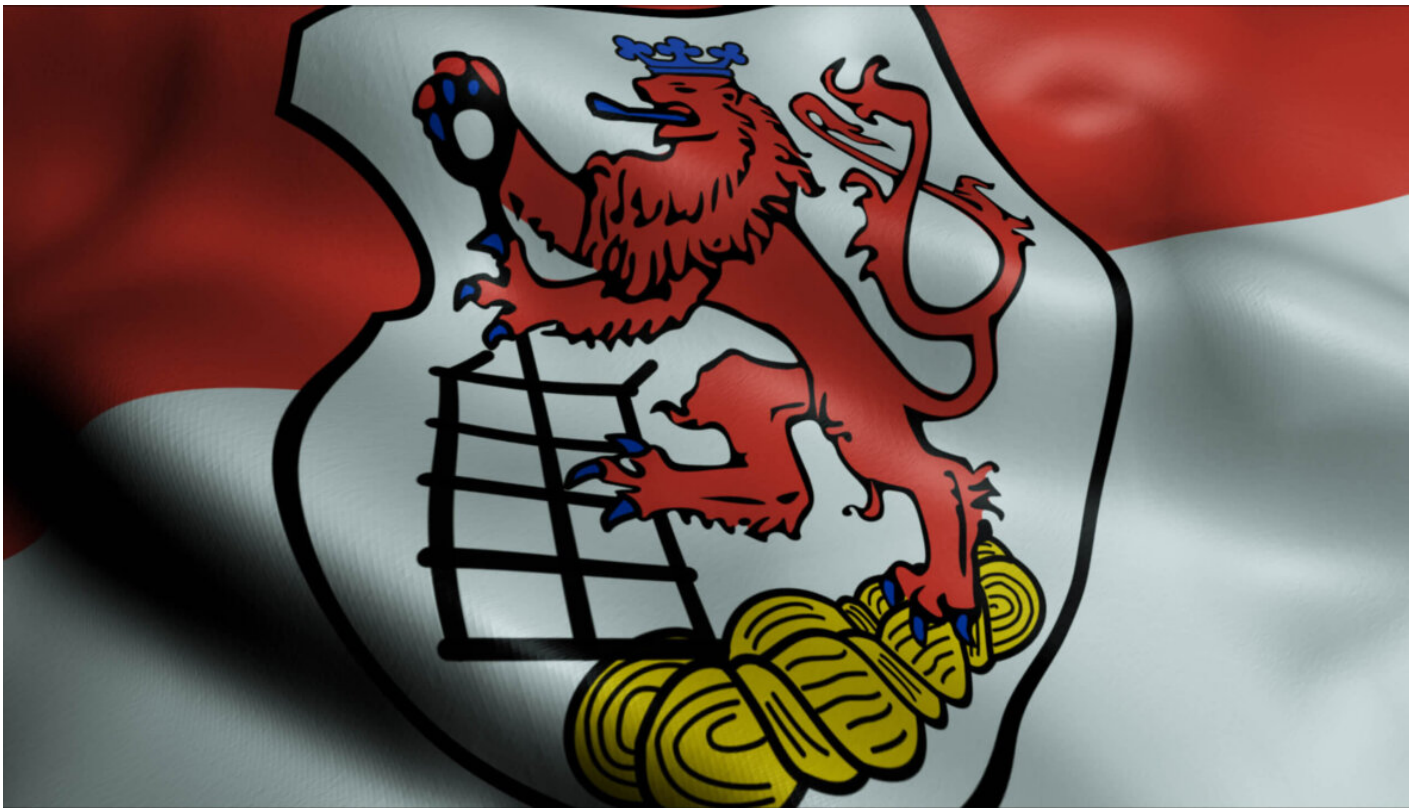


Wuppertal: Prize-winning centre of hydrogen mobility

By Stephen B. Harrison, Daniel W. Harker on Jan 05, 2021 | Translate NEWS

Wuppertal, a city in the North Rhine-Westphalia region of western Germany, has had a history of pioneering transportation technology since the construction of the suspended railway in the late 1800s. The 'Schwebebahn' suspended monorail is still in operation today.

A century later, Wuppertal is putting itself on the map for its innovative approach to mobility, with the implementation of a fleet of fuel cell electric buses, powered by the green hydrogen generated from the incineration of municipal waste.

Will Görtz leads the projects department at AWG Abfallwirtschaftsgesellschaft mbH (AWG) in Wuppertal, the city's waste collection and disposal organisation, and told H2 View, "We need to decarbonise fully by 2050 and that's really not far off. We must get started right now with ambitious projects that can be replicated and scaled."

Enabling decarbonisation of urban public transport

As of 2019, the first A330 FC fuel cell and hydrogen-powered buses (FCEBs) arrived in Wuppertal, with more arriving in 2020.

For every 10 FCEBs on the road, approximately 700 tonnes of carbon dioxide (CO_2) emissions from diesel fuel combustion can be eliminated per year. With an overall project budget of €12m, over half will be spent on purchasing FCEBs and the rest will be invested in hydrogen production, storage and fuelling systems.

The hydrogen comes from a 1.25 MW electrolyser, sourced from Hydrogenics. The PEM technology is essential to ensure that the hydrogen is free from impurities, to avoid the unnecessary degradation of the fuel cell catalysts, which would decrease performance. Also, the technology is perfect for this application where the electrolyser needs to start up and shut down frequently when the local electricity demand is low. This results in a minimised 'stress' level and ensures an environmentally and economically sustainable operation.

Integral to the design is a high-pressure hydrogen gas buffer storage, with capacity of 425kg of compressed hydrogen – enabling faster fuelling of multiple busses in rapid succession. This buffer storage allows the electrolyser to run intermittently when the cash value of exporting electricity to the local grid is low.

Packing a powerful punch

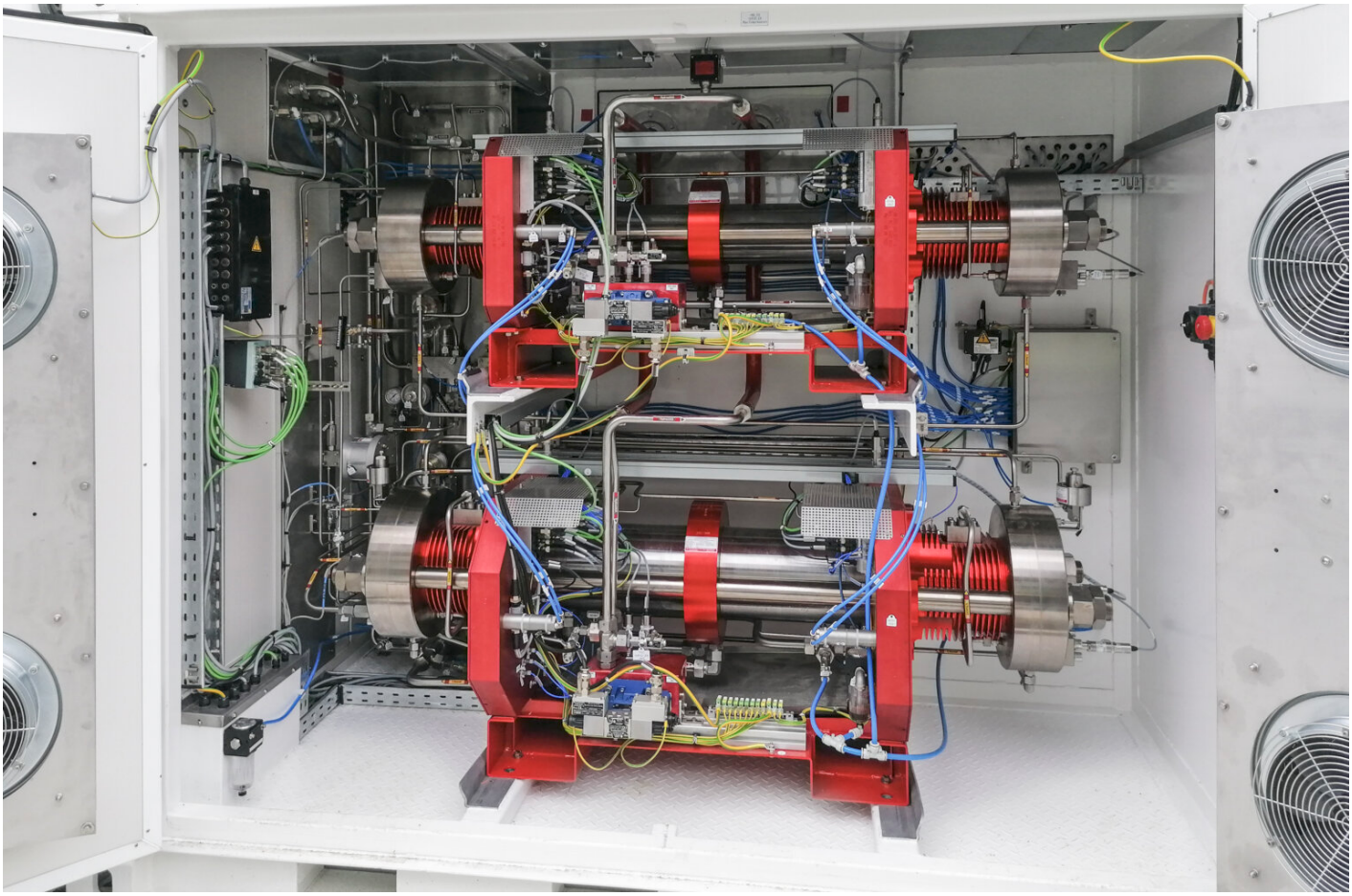
The gas compression system and fuelling dispensers for the hydrogen supply have been manufactured by Maximator GmbH.

Görtz explained that, "We chose to offer this project to Maximator because their system had the highest uptime availability and represented the best value for money."

Maximator: Hydrogen at speed and scale

Maximator has interests in high-pressure testing, components, and hydraulics. Its fuelling station utilises two stages of hydrogen compression with a gas intercooler between the stages. In the past, changing out the gasket was a time-consuming process that meant the fuelling station must be taken offline for several days. For pilot stations, that has been tolerated either by the acceptance of the downtime or the use of a second fuelling station to build redundancy into the system – at a significant cost. However, as hydrogen refuelling stations become an integral part of our mobility infrastructure, they must compete with traditional gasoline pumps and offer at least 99% availability.

Therefore, it holds multiple high-pressure sealing gaskets that are automatically loaded into the hydrogen fuelling station gas compressor. To fully automate the process a sensitive hydrogen gas detection system is employed: this is to measure leakages and determine the optimal timing to change the gasket.



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Green hydrogen from green electricity

The electrical power required for the PEM electrolyser will be generated from the combustion of municipal waste. Only the 'Restmüll' – the most difficult rubbish to dispose of – is used as feedstock to the waste-incinerator.

This waste has a biomass content of more than 50%, which combined with carbon dioxide emissions trading means that the electricity generated from the Wuppertal waste incinerator can be labelled as 'green'. Put in operation in 1976, the plant was purpose-built for power generation from the combustion of municipal solid waste.

Every year, around 400,000 tonnes of waste is burned in the AWG Wuppertal waste incineration power station and only a fraction of that is required to feed the hydrogen electrolyser. The incinerator represents a significant contribution to a positive carbon dioxide balance because the operation of the waste power plant saves immense amounts of fossil fuels and therefore reduces the overall environmental impact of power generation in the region. The flue gas scrubber contains a bank of filters to ensure that the power plant's emissions are normally less than 10% of the legal limit.

Regional prize-winners

Wuppertal was recently rewarded for its hard work, winning the North-Rhine Westphalia state competition for hydrogen mobility on 15th October (2020). In doing so, it obtained the title of 'Model Region for Hydrogen Mobility'.

During acceptance of the prize, Wuppertal Municipal Works CEO Markus Hilkenbach said, "When implemented correctly, sustainability must represent added value for our customers and urban society. Our hydrogen buses not only run without CO_2 emissions; thanks to the electric drive they also cause hardly any noise. That is also an important factor for residents."