

Embracing renewable hydrogen - Aberdeen comes first

By Stephen B. Harrison | 16 March 2021

Fans of hydrogen mobility may have read that 20 hydrogen-powered double decker buses will enter service in Birmingham in May 2022. But the West Midlands will not get the 'world-first' medal for operating a double-decker fuel cell electric bus fleet.

That honour has already been awarded to the city of Aberdeen, with 15 double-deckers operating in 2021 and another 10 due to join the fleet in 2022.

"The buses are running like a dream," says Councillor Philip Bell, Hydrogen Champion at Aberdeen City Council. "At present there is plenty of seating room, and when we get through this latest coronavirus wave, we expect them to be operating with standing-room only."

"Visionary projects like our double-deckers are good for the environment and they help to make hydrogen a part of daily life – which is what hydrogen will be for everyone in years to come."

gasworld spoke with Councillor Bell in an exclusive interview earlier this year, just as the bus fleet was running in. He explains how and why Aberdeen is embracing hydrogen faster than any other city in the UK. Aberdeen is no stranger to being out in front: in an alphabetical listing of UK cities, Aberdeen comes first!



Councillor Bell, tell us please, how will hydrogen play a role in the transition to renewable energy?

Hydrogen is an essential link the chain of renewable power and energy. It's here to stay and growing fast.

Aberdeen has been an offshore oil and gas hub since exploration and production in the North Sea began in the late 1960s and 1970s. I used to work offshore myself, and my son still does. But we all realise that oil and gas must transition to renewables.

I am also involved in AREG, that's the Aberdeen Renewable Energy Group. We want Aberdeen to be as famous for renewables as it is for oil and gas. It's an aspiration that we are making a reality. In the bay we have 11 offshore wind turbines, each rated at 8.8 MW and operating with a load factor of around 50%.

Grey, blue or green hydrogen... which colours are on the agenda in Aberdeen?

We have our sights firmly on blue and green. The offshore wind projects will expand to produce power for electrolyzers and that means green hydrogen.

But we cannot wait for the ramp up in renewables. The pace of decarbonisation must accelerate. We were targeting a 45% carbon dioxide (CO₂) emission reduction by 2030 but that has now increased to a 70% reduction. To go that fast, Scotland and other parts of the UK must use carbon capture and storage (CCS) to convert grey hydrogen production to blue.



St Fergus gas terminal, north of Aberdeen

Is there acceptance of CCS to enable blue hydrogen in the UK?

There is an unparalleled depth and breadth of offshore oil and gas experience bound up in many UK companies. There are so many geological experts, pipeline engineers and gas processing specialists. These skills will be transferrable to safely implement CCS schemes in the UK sector of the North Sea.

Let's take an example. The Acorn CCS Project will leverage existing gas processing infrastructure at St Fergus, just north of here. There are 420km of existing offshore gas pipelines which can be re-purposed for CO₂ transmission to permanent underground storage sites. Geologists estimate that 30% of the UK's offshore CO₂ storage potential lies within 50km of the St Fergus pipeline corridors. This gives us an incredible head-start that we simply must use to decarbonise quickly.

And moving from CCS to hydrogen. What can be done to ensure the safety and public acceptance of hydrogen?

Safety is of utmost importance and this is an issue where politicians and the media can take the lead. The technical matters of renewables and the energy transition are for the engineers. Councillors such as I in the City of Aberdeen and politicians in Holyrood or Westminster must take the lead to reassure the public that hydrogen can be used safely.

One way to do that is to set up meaningful demonstration projects to prove the point that hydrogen energy can be a perfectly acceptable part of our daily lives, just like petrol and natural gas are today.

How will the residents of Aberdeen be able to use renewable hydrogen energy?

The buses are a good start. And we already have two hydrogen fuelling stations. The one at Kittybrewster in the heart of the city is capable of 350 bar for buses and large vehicles and can also fill to 700 bar which is the standard for cars. It uses very pure hydrogen from electrolyzers to ensure that the hydrogen is compatible with the sensitive PEM fuel cells that are used in cars and buses. The hydrogen that we use for mobility is renewable. That's because the electricity feeding the electrolyzers is supplied on a green tariff.

We only run the electrolyzers at night when the power demand from residents and industry is low. They are PEM units that produce hydrogen which is stored safely at high pressure on the fuelling station. The storage banks are depleted during the day when the buses and cars come to refuel and then recharged again overnight. At present we have 500kg of hydrogen capacity which is adequate for our current fleet of hydrogen vehicles. In 2024 this will ramp up to 3,500kg per day to power local trains that will run from here to Inverness and Stonehaven on hydrogen.

We also have plans for a new housing estate called Cloverhill where 550 properties will be constructed. Of those, 150 will be social housing and each home will be installed with a hydrogen-fuelled micro-CHP solid oxide fuel cell capable of 750 W of power and 1.5 kW of heat. With the potential for wind power that we have offshore, we will ultimately be able to use electrolyzers to make renewable hydrogen which can be distributed to these homes in gas pipelines.



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What will other renewable infrastructure projects are underway in the city?

If you want to experience renewable energy in our city, TECA (The Event Complex Aberdeen) is a great place to start. This exhibition and conference centre is the largest of its kind in Scotland and was opened in 2019. The building and the supporting hotels are heated and powered by three hydrogen fuelled solid oxide fuel cells.

The fuel cells are fed with biomethane and include integral steam methane reformers (SMR) to produce the hydrogen. Each one pumps out 440 kW of power and 460 kW of heat. That's enough to see us through the coldest of Scottish winters. The great thing about the biomethane for those fuel cells is that it is renewable. It comes from anaerobic sludge digesters. One third of the UK's natural gas is landed at St Fergus not so far from here, and despite the abundance of natural gas close by, we have made the transition to renewable sources of biogas.

Furthermore, we have plans for a waste to energy plant which will produce 12 MW of power for the city. It will come on-stream around Q3 2022. The plant will also produce 40 MW of heat, which will be carried by moving hot water around through insulated underground pipelines. This process is efficient within a 12km radius, so we will be able to add an additional 40 MW of waste heat from that power plant to extend the five existing heat networks for homes and buildings in the City.

What job opportunities will be created in Aberdeen related to the energy transition?

The transition to the new renewable energy infrastructure will create tremendous opportunities for skilled work. The massive 100,000 tonne Condeeps for the Brent Charlie and Ninian oil platforms were built in Scotland. They now stand on the seabed 120km offshore. They are huge concrete structures that support over 20,000 tonnes of

topside modules and equipment.

Scotland could once again use its skills and facilities to build floating concrete wind turbine structures with the blades and other high-tech systems built in Aberdeen's proposed energy transition zone (ETZ). The ETZ would be part of the new deep-water south harbour which should be completed in 2022. And wouldn't it be fantastic if our new harbour was awarded 'free-port' status. The free-port would then become home to many sustainable industries and with tax-free access to worldwide markets, their competitiveness would be ensured.

I am also researching the latest developments in the use of CO₂ locked into concrete. Perhaps we can utilise captured CO₂ to create the foundations for these wind turbines which would contribute to Aberdeen's vision of becoming a climate positive city.

How can local people skill-up to work in the hydrogen economy?

That couldn't be easier. Aberdeen University offers an MSc in Renewable Energy Engineering. And NESCOL offers a specialised course for Hydrogen Technicians. That will provide the skills to maintain fuel cells, hydrogen cars, FCEBs, hydrogen powered trains and our hydrogen fuelling stations.

We are creating the UK's first 'Hydrogen Valley' here in Aberdeen, and we are proud of it.

About the author

Stephen B. Harrison is Managing Director of sbh4 Consulting, and also a member of the **gasworld** Editorial Advisory Board.

Harrison has over 30 years' experience of the industrial and specialty gases business.