A hydrogen fueling station at Cologne airport and, right, a hydrogen electrolysis stack.

HYDROGEN BUILDING BLOCK FOR THE NEW ECONOMY

In a previous article on buses, I promoted the use of hydrogen as a fuel for vehicles.

Hydrogen is a clean fuel but, at the present stage of its development, it is more expensive than LPG, petrol, diesel or pure electrical power, and not easily available.

However, as with all new technologies in development, as it matures to become commercially applicable, its prices will drop to affordable levels.

For hydrogen, its price and environmental impact hinges on the method of production. Some analysts like to classify hydrogen production by color codes.

Green hydrogen, the cleanest of all, is produced by electrolysis of water using renewable energy.

Wind and solar power is becoming common, and, due to the weather and demand patterns, excess electricity is very often produced.

Green is used to describe such a process, as practically no carbon is emitted.

Another form of production by electrolysis uses nuclear energy, which is environmentally friendly and economical, with excess power usually available at off-peak hours. The product of nuclear energy electrolysis is pink hydrogen.

Another power source for electrolysis is directly from the grid, which may consist of a combination of fossil fuels, nuclear and renewable energy power plants, and the product of this process is termed yellow hydrogen.

Another altogether different producion method is the chemical process of steam methane reforming of natural gas.

Natural gas is mixed with hot steam and reformed using a catalyst. Hydrogen and carbon monoxide are produced, and to ensure safety, the latter is then converted to carbon dioxide, which is then captured and stored underground by a process called carbon sequestration.

Methane is produced as a by-product, so unless it can be stored and reused, it is again not desirable from an environmental protection perspective. This reforming process produces blue hydrogen.

A derivative of blue hydrogen is grey hydrogen, a simplification of the blue hydrogen production process but without the carbon capture.

Obviously, this is not a desirable as it emits carbon dioxide into the atmosphere.

In case I have confused you with these color codes, I am only trying to explain the various production processes available for hydrogen today that are at the development stage.

I am sure eventually they can be prioritized for good commercial applications.

Other obstacles to the application of hydrogen power include the methods of storage and transport, which again are still in the developmental stages.

Fortunately, hydrogen is light, compressible and can be stored at high pressure, so large quantities can be transported economically.

The limit is the strength of the tanks. But with modern synthetic materials, safe storage and transport should no longer be an issue.

As we continue to try to minimize emissions, alternatives to fossil fuels for vehicles are urgently needed.

When we can find efficient production processes for hydrogen with minimum emissions of undesirable by-products, we will be able to live in a cleaner world.

A country with a lot of potential for renewable energy application will benefit more from a hydrogen economy, and China has huge potential in this regard.

With hard work and focus from scientists and engineers, we may not need to wait too long. I estimate it would be commercially available in the next decade or two, replacing battery-driven vehicles.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over features of modern life