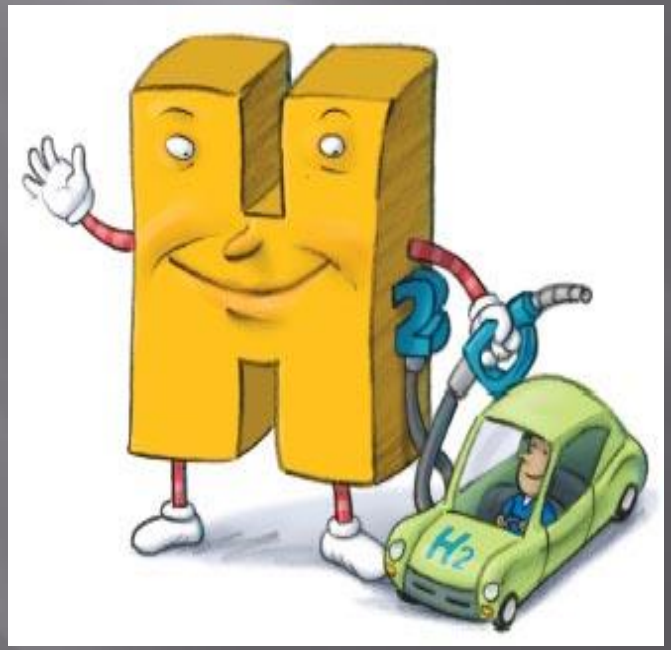
Unit 4 Hydrogen Distribution and Safety



HyTrEc
Hydrogen Transport Economy for the North Sea Region
The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region
European Union
The European Regional Development Fund

Aims

The aim of this unit is to:

- identify and understand hydrogen distribution processes
- identify the necessary safety considerations when dispensing hydrogen

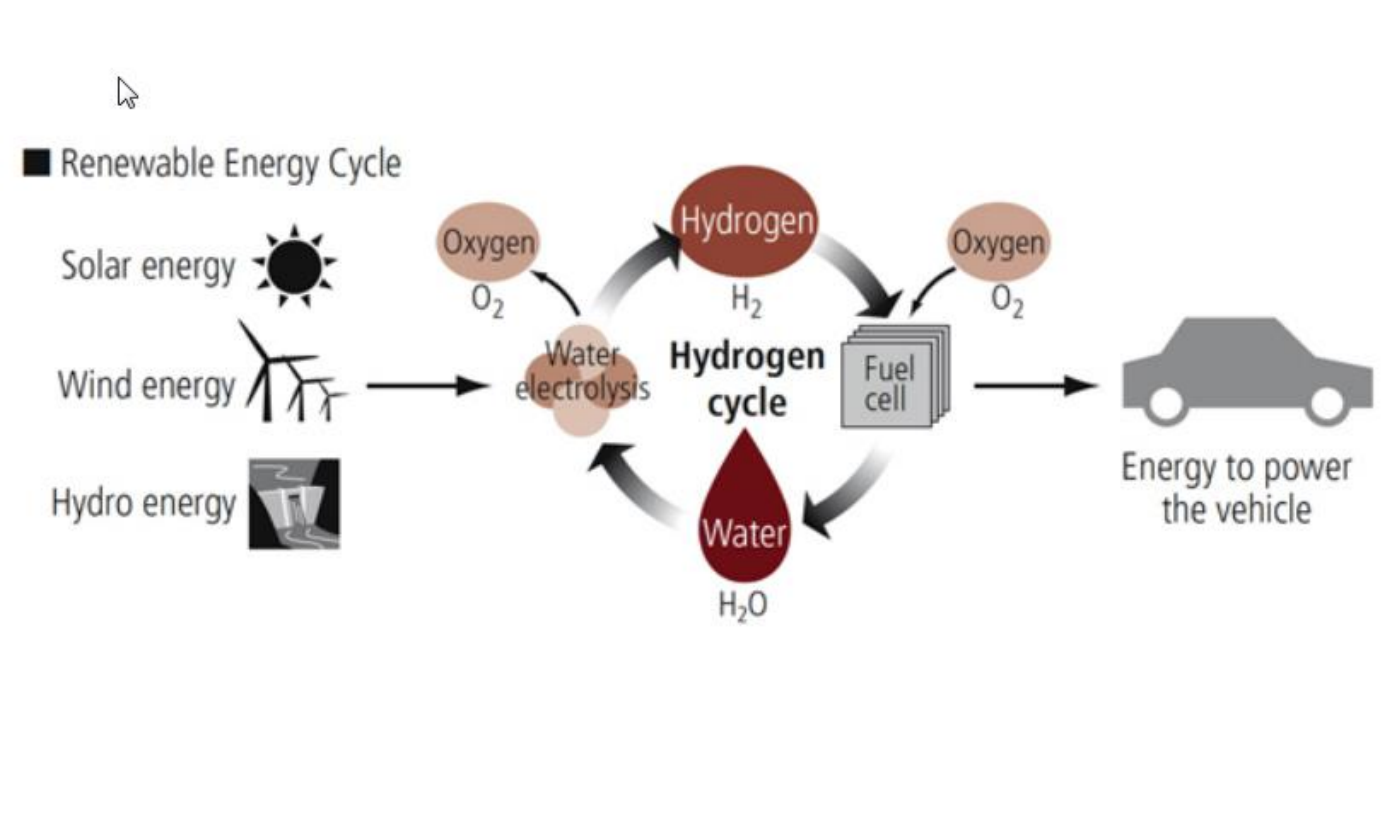
Transportation and Hydrogen

Transportation and Hydrogen

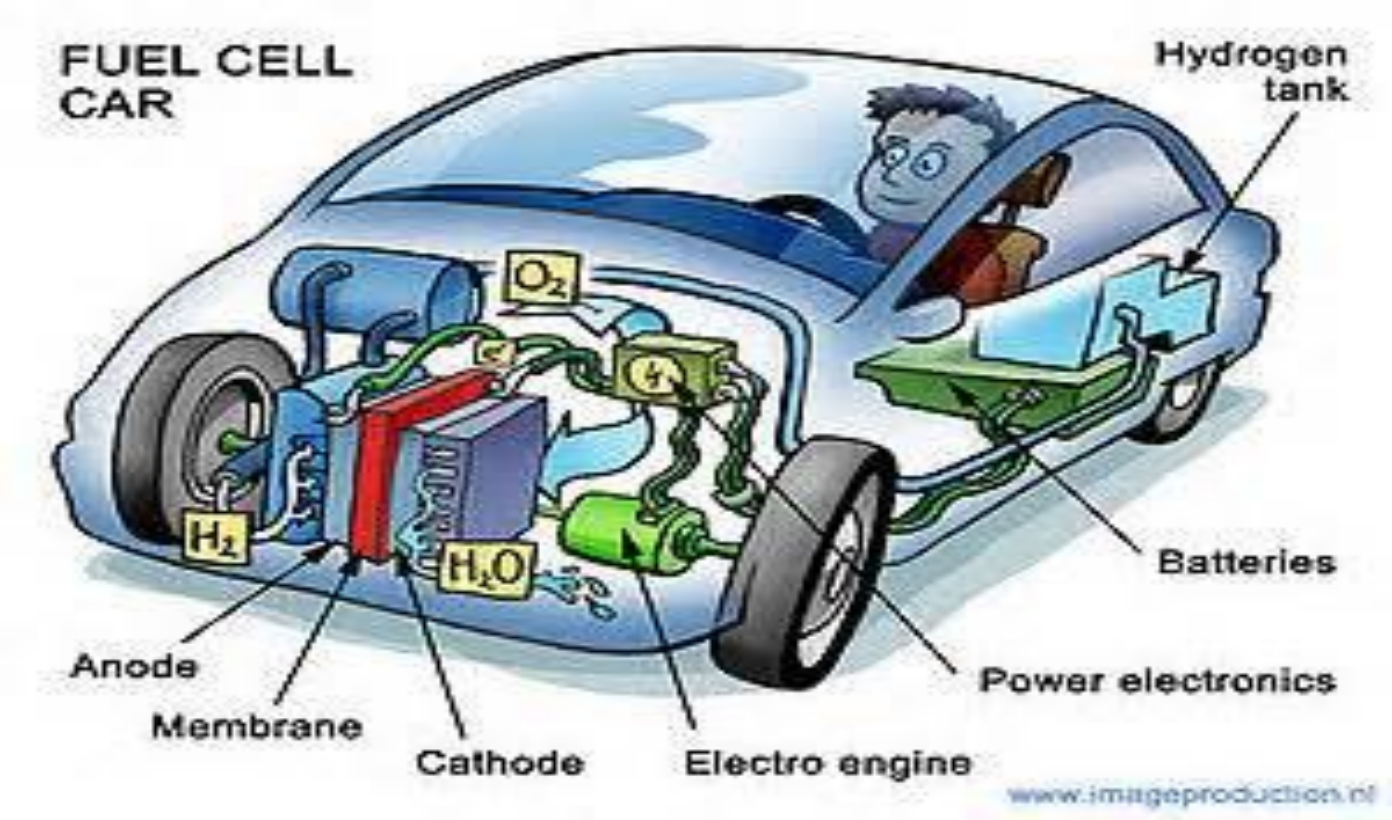
Many vehicle manufacturers are turning to Hydrogen as a fuel source to propel their next generation of environmentally friendly vehicles.

Used with a Fuel Cell or an internal combustion engine, hydrogen also has many risks associated with its distribution, storage and handling.

Ultimate Goal



Ultimate Goal



BMW and Toyota

BMW H.I.C.E

Toyota FCHV

Is it possible?

1. How is hydrogen transported?
2. What are hydrogen's end uses?
3. How is hydrogen used as an energy source?
4. How will you dispense hydrogen?

Primarily, hydrogen is a CARRIER not a source of energy

Hydrogen Distribution

Over the years hydrogen has been delivered safely mainly through distributed pipelines or over the road.

Scaling up the hydrogen infrastructure for mass distribution and delivery to thousands of individual hydrogen dispensers will present numerous challenges.

Hydrogen contains less energy per unit volume than petroleum; transporting, storing, and delivering it to the point of end-use is more expensive.

Constructing hydrogen pipeline networks will involve high initial capital costs.

The properties of hydrogen present unique challenges to pipeline materials and compressor designs.

Hydrogen as we know can be produced from a wide variety of resources.

Hydrogen Distribution

There are considerations between centralised and distributed production to consider.

Producing hydrogen centrally in large plants cuts production costs but boosts distribution costs.

Producing hydrogen at the point of end use, at fuelling stations, for example—cuts distribution costs but boosts production costs because of relatively low production volumes.

Tube trailers transport bulk quantities of hydrogen gas, while cargo tanks carry bulk liquid hydrogen.

Hydrogen Distribution

Hydrogen can be transported through three methods:-

1. PIPELINE: This least expensive way to deliver large volumes of hydrogen. At the minute it is limited to 800 miles across Europe and 700 miles in California.

Hydrogen Distribution

2. HP TUBE TRAILERS: Transporting compressed hydrogen gas by truck, railcar, ship, or barge in high-pressure tube trailers is expensive and used primarily for distances of 200 miles or less.

Hydrogen Distribution

3. LIQUEFIED HYDROGEN TANKERS: Cryogenic liquefaction enables hydrogen to be transported more efficiently over longer distances by truck, railcar, ship, or barge compared with using high-pressure tube trailers, even though the liquefaction process is expensive.

Hydrogen Dispensers

Hydrogen and gasoline dispensers look similar in that they both have hoses and nozzles, as well as displays that often incorporate touch-screen or push-button point-of-sale systems.

However, hydrogen is sold by mass (kg), rather than by volume (litres) as in the case of petroleum.

Filling a vehicle's hydrogen tank sounds a lot like filling a tire with air.

Hydrogen gas can be dispensed at a pressure of either 35MPa (H35) or 700 MPa (H70), with a separate nozzle and hose required for each pressure.

Hydrogen Dispensers

High pressure nozzles (H70) incorporate two-way communication between the vehicle and the station via infrared (IR) transmission. This allows the dispenser to fuel the vehicle more quickly while maintaining customer safety. As a result, high pressure refueling takes less time and increases a vehicle's on-board hydrogen storage capacity and driving range.

**** NOTE ****
H70 nozzles cannot be used to fill a vehicle that is only capable of H35 fills; however, H35 nozzles can be used to provide a half fill on vehicles with H70 on-board tanks.

Hydrogen Dispensers

The connection between the hydrogen dispenser nozzle and the fuel cell vehicle must be properly secured and sealed to prevent hydrogen leakage.

Hydrogen gas will not flow out of the station's storage tanks until the nozzle is properly attached to the vehicle.

Once the dispenser nozzle is properly connected to the vehicle, the high pressure hydrogen gas flows from a storage tank into a cooling unit that is located in the dispenser, and then through a high pressure hose and certified nozzle into the vehicle's storage tank.

If the vehicle requires H70 pressure, then the hydrogen gas passes through a boost compressor before entering the dispenser.

Once the vehicle's tank is full, the dispenser automatically stops the flow of hydrogen.

The filling time of a hydrogen fuel cell electric vehicle is similar to filling a gasoline tank of a conventional car, typically around five minutes.

Hydrogen Refuelling Station

Most hydrogen stations consist of storage tanks (above-ground), compressors, a chiller, a boost compressor, a dispenser, a hose and a nozzle.

Hydrogen can be either produced on-site or delivered to the hydrogen station (by truck or pipeline) in a gas or liquid form.

For liquid delivery, the liquid hydrogen is stored on-site and converted to gaseous form using vaporization on an as-needed basis when the gaseous storage runs low. The vaporized hydrogen is then compressed for on-site storage in high pressure gaseous storage tanks, ready for dispensing.

The type of compressor needed may vary, but only compressors that have been designed to compress hydrogen to high pressures (up to 100 MPa) are suitable.

That's it! Well done.

Once you have successfully completed the Unit 4 test you have completed the hydrogen awareness course.

Well done.