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Hydrogen Production

Hydrogen might be the most abundant element on Earth but it is rarely found in its pure form. This means that in order to use pure hydrogen, it first needs extracting from its compound. Any extraction process requires a primary source of energy so it is important to remember that hydrogen is a secondary energy source. There are many ways to produce or extract hydrogen (for further explanation, see the accompanying powerpoints).

In brief, hydrogen can be produced from fossil fuels, such as natural gas and coal, biomass, non-food crops, nuclear energy and renewable energy sources such as wind, solar, geothermal and hydroelectric power. The diversity of potential supply sources is THE most important reason why hydrogen is such a promising energy carrier.

Currently, most of the world's hydrogen production takes place through a more CO₂ intensive process called Steam Methane Reforming (SMR) but through processes involving renewable primary energy sources, hydrogen energy can be an entirely clean source of power.

Like electricity, the use of hydrogen does not produce any harmful emissions. Its production mode determines its carbon footprint and therefore only hydrogen produced from carbon free renewable or nuclear energy is carbon free.

The main processes for deliberate hydrogen production are outlined below:

Thermochemical Processes - As their name suggests, these processes use heat and chemical reactions to release hydrogen from organic materials such as fossil fuels and biomass.

Electrolysis or 'water splitting' – Water is split into Hydrogen (H₂) and Oxygen (O₂) by means of an electric current being added to it.

Biological Processes – Hydrogen is produced from microorganisms such as bacteria and algae.

One more source that can be exploited is industrial residual hydrogen. This is hydrogen produced as a by-product of other industrial processes. Hydrogen from this source can be broken down into three categories: The 'merchant' category supplies hydrogen to other industrial customers, the 'captive' category retains hydrogen on site for its own use but 'by-product' hydrogen has no further use within the original process so can be made available for other applications such as fuel cell electric vehicles.

Areas with high quantities of hydrogen as a by-product are the most advanced in their hydrogen deployment strategy because it can be used in on-site applications easily and cheaply.



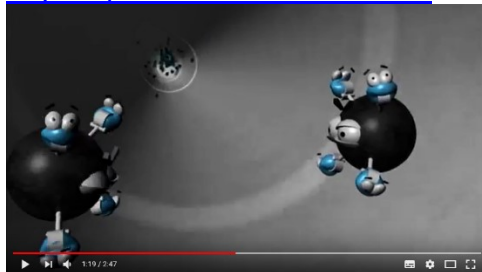
Links to additional resources for this topic

Production Student Powerpoint	Production Extra Information for Teachers	Production Case Study - Linde	Kahoot Quiz
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Production videos with descriptions

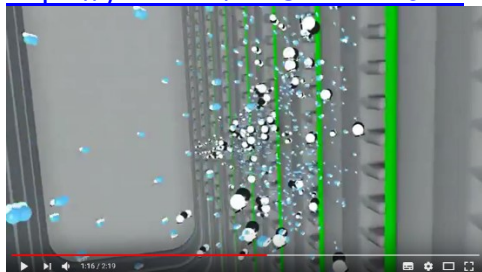
Production - Animation - Video on generating hydrogen from steam methane forming – 2.47 English with all other subs

<https://youtu.be/eoF2EoFhJw>



Production – Animation - Solid oxide fuel cell - generating electricity and heat at the same time – 2.20 – English with all other subs

<https://youtu.be/ASCWMI4A3ZY>





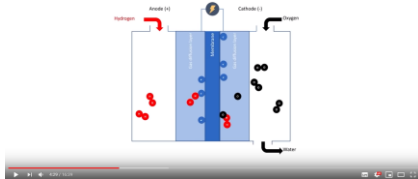
Production - How it's made - Hydrogen Fuel Cells 5.00 – English with all other subs

<https://youtu.be/LDwS31OE7ak>



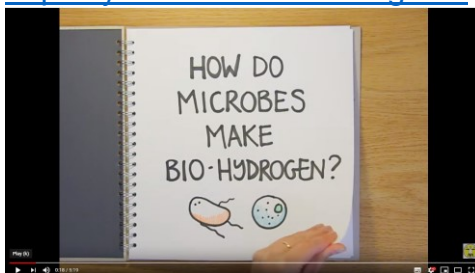
TED Talk about hydrogen production and usage 16.39 – English with all other subtitles

<https://youtu.be/jFYbmTV-itl>



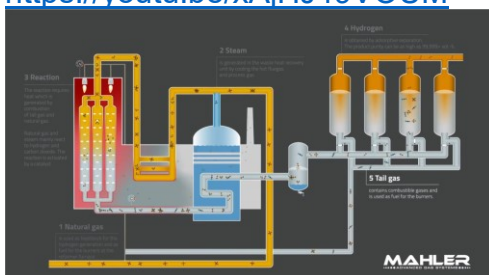
How do we use microbes to make hydrogen? 5.19 – English

<https://youtu.be/ComvWDLqwV4>



Hydrogen generation by steam reforming 2.25 – silent but with English labels

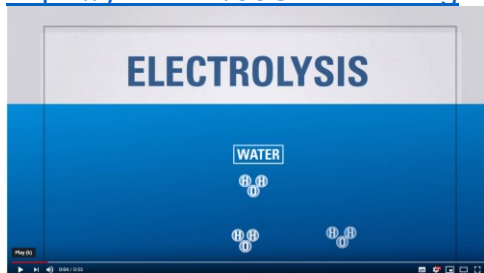
<https://youtu.be/xAIHJ49VOUM>





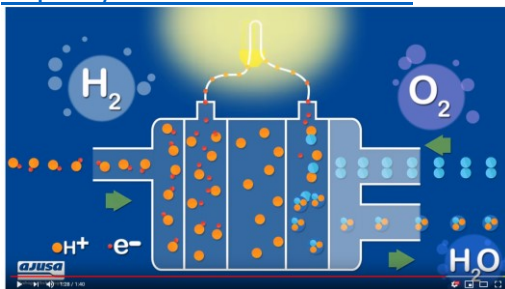
Electrolysis animation 0.53 – English

<https://youtu.be/38ULHoKWZaq>



FC animation 1.40 – Silent with English labels

https://youtu.be/imV_uflzxPY



41.29 Hydrogen Oxygen Separator Electrolyser

<https://www.youtube.com/watch?v=iehzjEhM1DU&feature=youtu.be>

