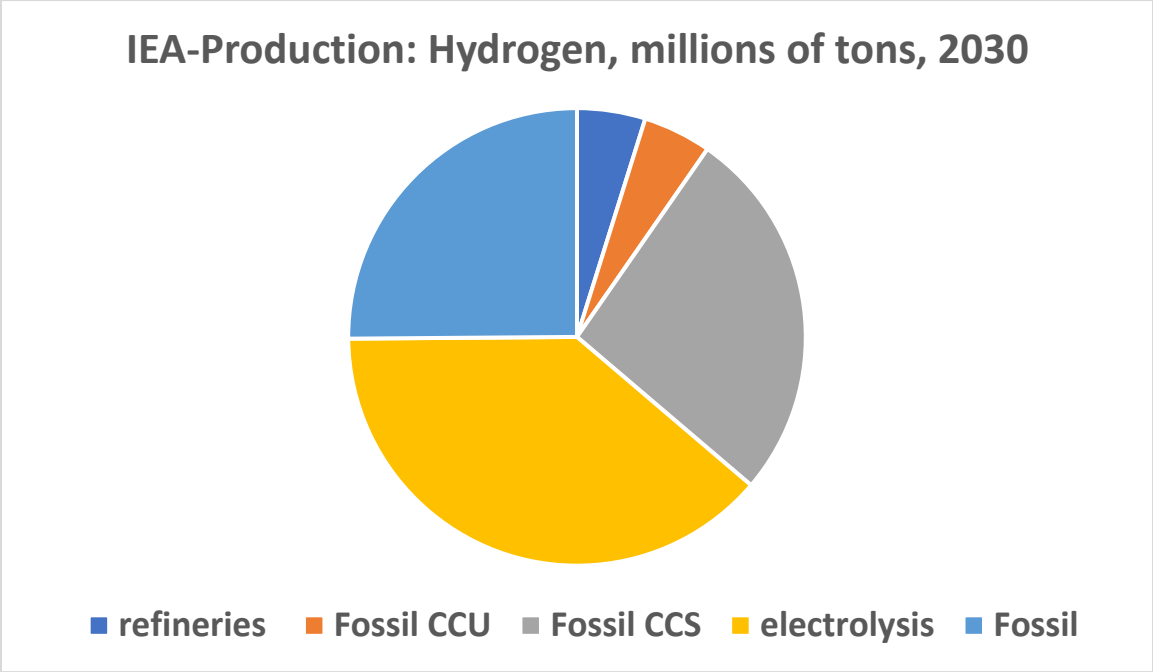
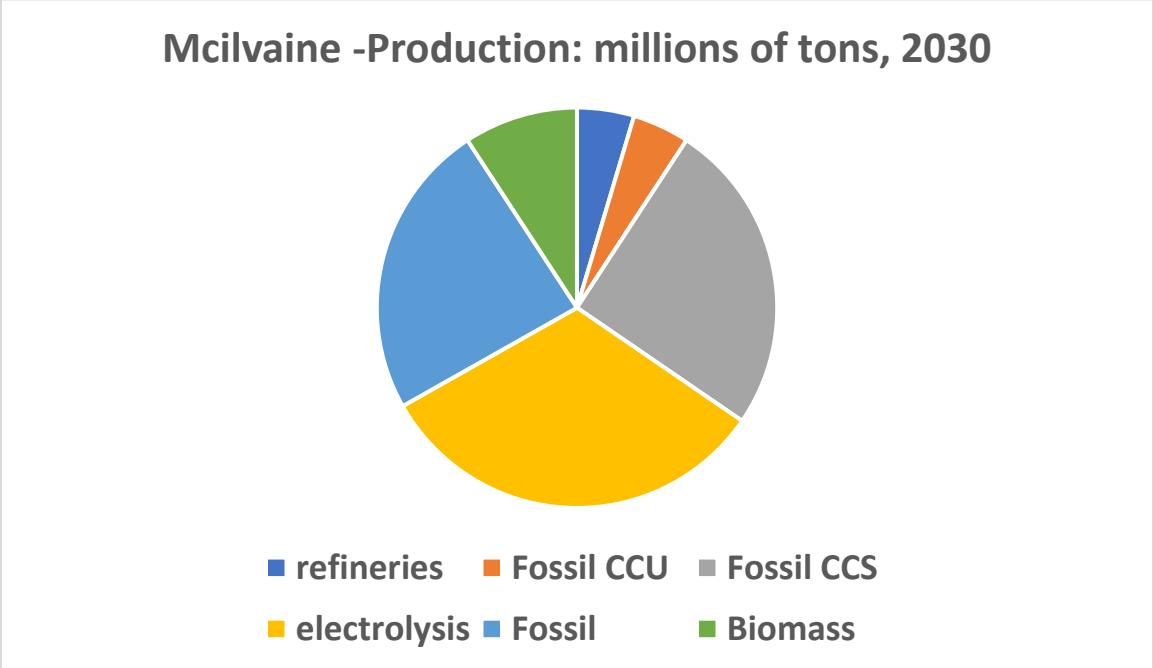
Valve Selection for Hydrogen Production

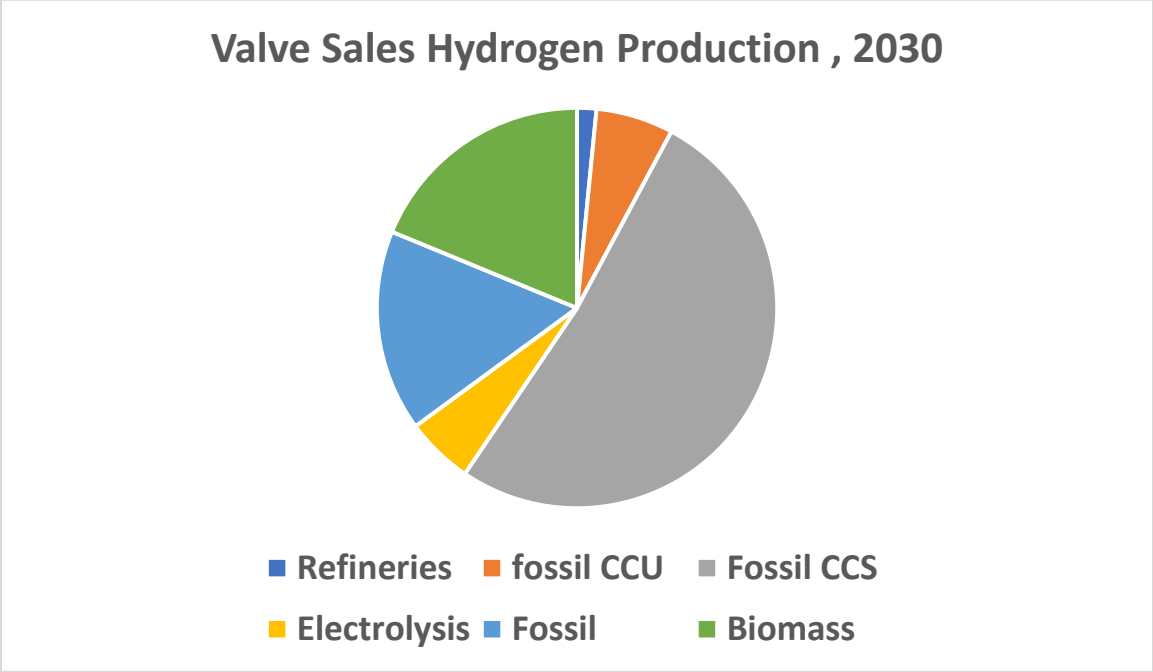
By 2030 there will be over 200 million tons of hydrogen produced under the Net Zero climate change program. Hydrogen sales will generate revenues of over $ 400 billion.



The IEA forecast for 2030 projects electrolysis as the largest production mode followed by fossil fuels (mostly natural gas) without carbon capture. An equal amount will be produced with carbon capture and sequestration. A relatively small amount will be produced with carbon capture and beneficial utilization



Mcilvaine company believes that biomass including waste can be a significant source of hydrogen. An analysis has been prepared based on 20 million tons of biomass based hydrogen by 2030



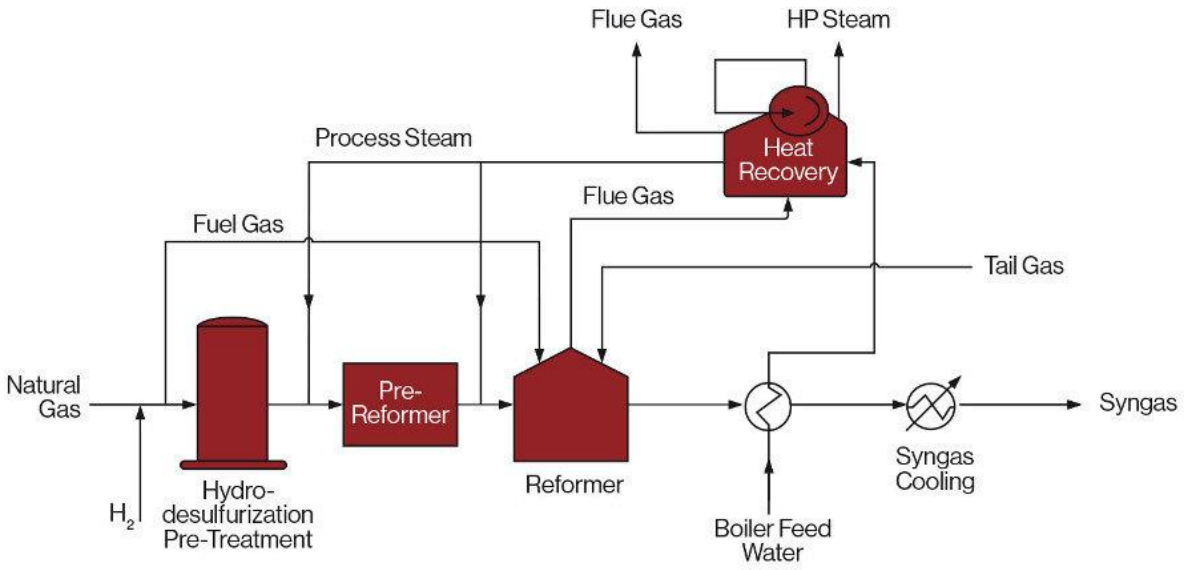
Valve sales for hydrogen production could exceed $ 3.5 billion in 2030. One variable is the mix of technologies. The relative valve revenues per ton of hydrogen for electrolyzers is tiny compared to fossil with CCS. So electrolyzers will not be a significant source of valve revenue compared to the other production sources.

It should be noted that these estimates are only for hydrogen production. Separate estimates are being made for hydrogen liquefaction, transport, storage and combustion. For electrolyzer produced hydrogen the valves for liquefaction, storage, and transport will be greater than for production.

Valve Selection

There are many processes within each production category where there are unique valve requirements. Decisions need to be made on which valve in each niche has the lowest total cost of ownership. Given the rapid technology and industry developments' this is an ongoing task

The number of processes using valves is illustrated in the following example

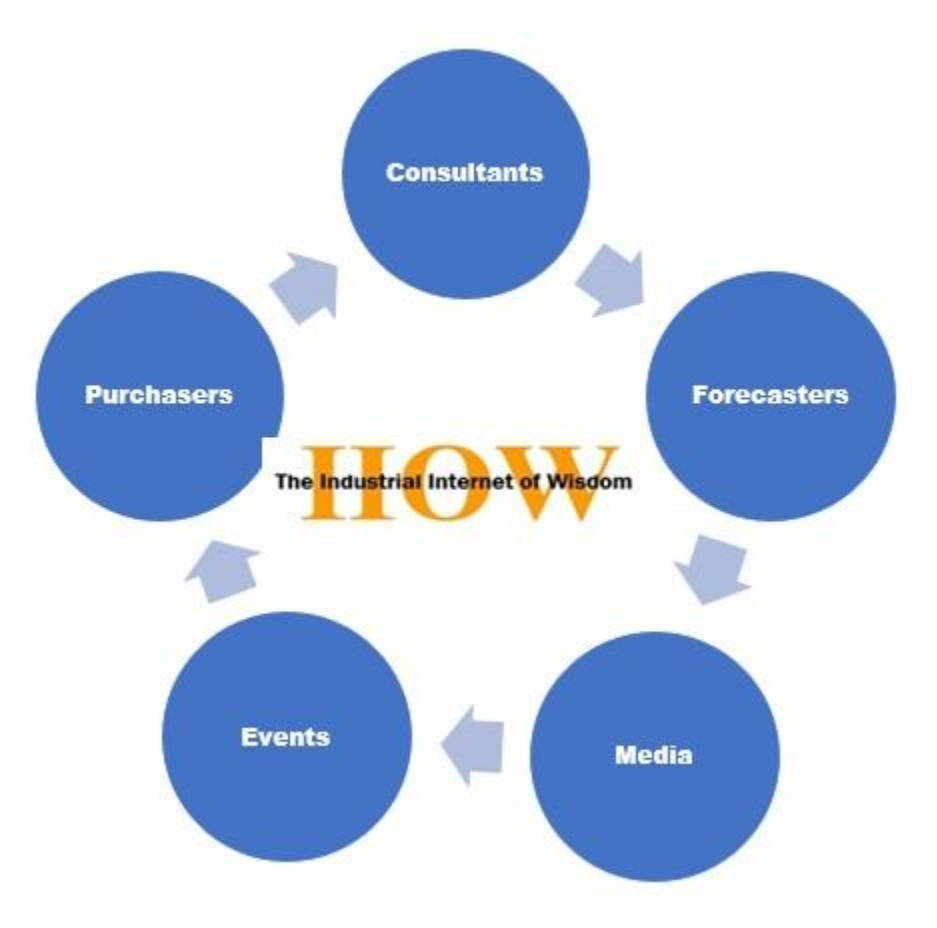


Air Liquide Engineering & Construction provides Steam Methane Reforming (SMR) technology for hydrogen production on both a small and large scale. SMR is a cost-effective and energy efficient way of producing hydrogen. High levels of purity can be reached by employing in-house Pressure Swing Adsorption purification technology.

In the steam reforming process, a desulfurized hydrocarbon feedstock (natural gas, refinery off gas, liquefied petroleum gas or naphtha) is pre-heated, mixed with steam and optionally pre-reformed before passing a catalyst in a proprietary top-fired steam reformer to produce hydrogen, carbon monoxide (CO) and carbon dioxide (CO_2). The CO is shifted with steam to additional hydrogen and CO_2, and the hydrogen is then separated using Pressure Swing Adsorption.
Some processes use molecular sieves for gas dehydration and purification. In an attempt to determine the best molecular sieve switching valves, Mcilvaine sought input from the suppliers. Different offerings were then compared.
Many valves have been used on this service, but few are performing as might be wished. Three valve designs are usually found in molecular sieve unit switching valve service: (1) metal-seated ball valves; (2) metal-seated, triple off-set butterfly valves; and (3) metal-seated, non-contacting, rising stem ball valves. Some rotary valve options such as the triple offset butterfly valves are relatively inexpensive to purchase and may perform adequately in the near term. Operators, however, have generally found them to be deficient in sealing capability, expected service life and total cost of ownership. Process disruption, high MRO expense and the inability to deliver a minimum of five years of continuous service between planned shutdowns have all been persistent negatives.

Historically the rising stem ball valve (RSBV) has been used in this application. But the selection is complicated and depends to some extent on the severe conditions existing. Zero-leakage carbide coated metal seated ball valves can be a preferred option in particularly severe service.

This one example shows the magnitude and complexity of making the best choices with rapidly changing technologies. This challenge is best met by connecting the suppliers, users, consultants', and media in an organized way. through the Industrial Internet of Wisdom.



Suppliers of valves for hydrogen production processes have been asked to supply examples of lower total cost options which they provide.

Ampo

Diverse axial check valves were installed at GURU GOBIND SINGH, the fifth biggest refinery in India.

These axial check valves are in hydrogen service and protect the rotating equipment, avoiding back-flow and preventing hammer-water. More than 2000 engineered gate, globe and check valves were supplied to the Eurochem Kinisepp plant in Russia. Construction was duplex stainless steel, stainless steel, low alloy steel and carbon steel. The valve' sizes range from 2" to 42" and the pressure range is from 150 lbs. to 2500 lbs.

Baker Hughes

Bray
Crane
Emerson
Flow Serv
Habonim
ITT
Kitz
Leser
L & T

Neles
Neles has delivered almost 7,000 valves and over 6,000 actuators for hydrogen production in the past 10 years. In methane reformer processes Neles valves perform well under the challenging pressure and temperature requirements. Electorlyzers need fast response time. Neles positioners are excellent for providing fast and extremely accurate valve control.

Parker (Bestobell)
Samson
Schlumberger (Cameron)

Trillium
Valco