

Blue Hydrogen Production from Coal

Introduction

Greengauge Hydrogen have been asked to review options for the production of hydrogen using coal as the feed in India.

Greengauge would be interested to assist and be the project management consultant representing the client in the technology selection, feasibility study, to oversee a FEED (Front End Engineering Design) study with an appropriate licensor and engineering company, oversee and assist during the detailed design phase with an EPC (Engineering / Procurement / Construction) company and then act as the company representative during the construction phase.

Greengauge would then lead the project through commissioning, start up and operations and assist during the operations phase to lead to a safe, reliable and profitable process and beyond.

Greengauge would like to have contact with the client to introduce ourselves and discuss a way forward for this project – this can either be over WhatsApp, Teams, Zoom and / or we can visit the client in India.

Overview

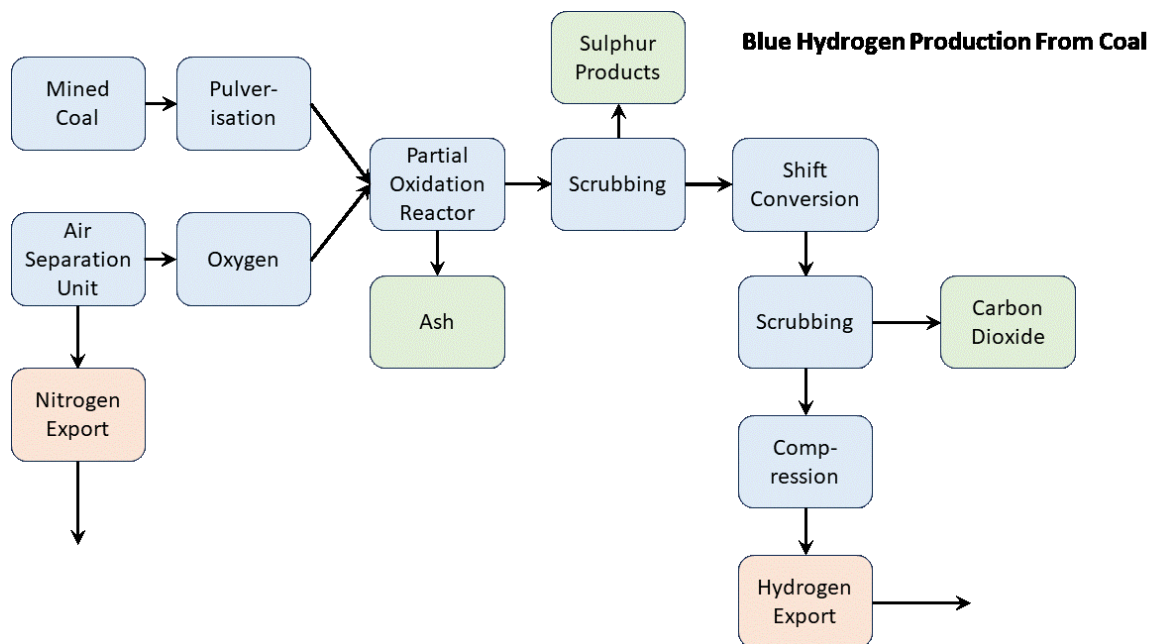
According to the literature, 18% of the world's hydrogen is manufactured from coal – the technology for this process is available. A review of the technology is required once more information is available from the client (coal quality, plant size, environmental requirements, by-product handling, downstream users etc.) – Greengauge are available for this workscope.

One of the Greengauge engineers has experience of the Texaco gasification technology (now GE technology) from plants in Hull, UK and Bulwer Island Australia (ex-BP plants). These plants used natural gas rather than coal, but the technology is similar and Texaco offer a coal option for the feedstock.

The Texaco option would be to pulverize the mined coal, partially oxidize with oxygen or steam in a reactor and then scrub free any sulphur species, water and carbon dioxide to produce syngas. The syngas would then be shift converted to make further hydrogen and carbon dioxide. Further scrubbing and compression would produce hydrogen for export.

The oxygen source would be from an air separation unit leading to large volumes of high purity nitrogen being available. With the hydrogen production, one idea would be to react the nitrogen with the hydrogen to produce ammonia for fertilizer production. The ammonia plant could either be a part of the asset or outsourced to a 3rd party ammonia producer.

The Texaco gasification process is used as an example in the following information:



Detail

Greengauge is aware of licensors that have the ability to produce hydrogen from coal and would be interested in representing the client with the progression of the project from the technology selection and feasibility stage and all the way to the production stage and beyond with the assistance of appropriate licensors, engineering contractor and EPC company.

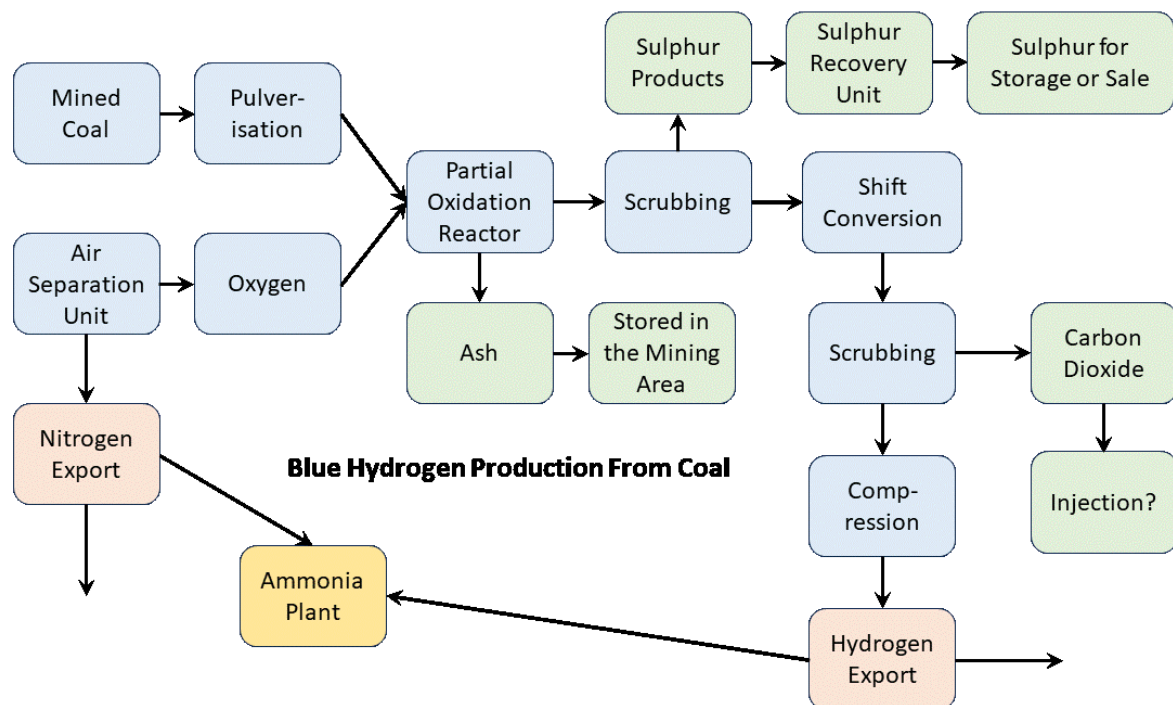
By products would be ash from the Texaco partial oxidation reactor, sulphur products from the sulphur content of the coal and carbon dioxide from the Partial oxidation plant and shift conversion reaction. Ash could be returned to the mined area. Sulphur products could be released to atmosphere (depending on the amounts and government legislation on emissions) or sent to a Claus sulphur recovery plant to produce elemental sulphur – this can be either stored in the mining area or sold on the open market. Carbon dioxide can either be sent to atmosphere or compressed and dried and injected into a subsurface reservoir (if available). This would assist in the environmental performance of the plant to meet any present and future environmental standards. If Blue Hydrogen is required, then excellent environmental performance is required and the by-products have to be appropriately treated to have minimal environmental impact.

With the production of hydrogen and nitrogen, if there is a nearby market for ammonia and fertilizer production, then this would seem to be a sensible use for the products. Ammonia is simpler to transport in bulk than hydrogen and nitrogen.

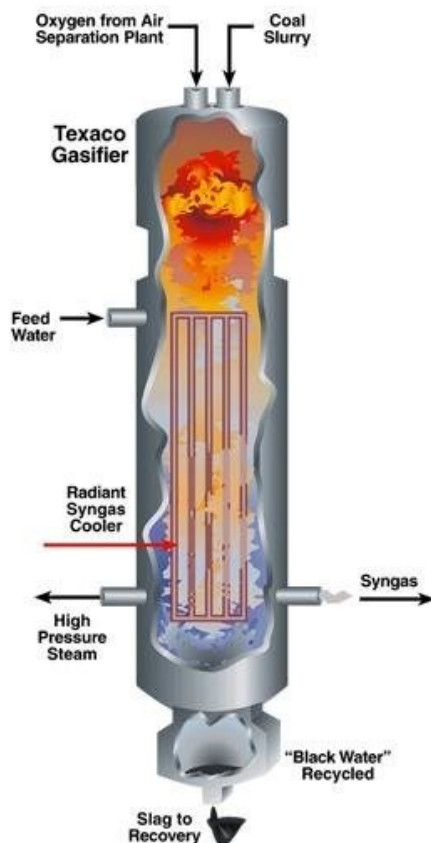
Air separation units, ammonia plants and sulphur recovery plant designs are well known commercially and licenses could be obtained for the design, construction, commissioning and operation of these plants.

To reduce carbon dioxide production, another option is not to install the shift conversion reactor that produces a mole of hydrogen from a mole of carbon monoxide to produce a mole of carbon dioxide. Carbon monoxide is a useful product and can be used to produce acetic acid / acetic anhydride using a methanol carbonylation process as an example. This does however reduce the hydrogen production.

A wealth of chemicals can be produced from syngas, so these options can be reviewed if required by the client.



Texaco Gasifier using Coal



Greengauge

Greengauge engineers have around 40 years' experience (each) in the areas of Chemical, Oil and Gas Plants. Experience of Texaco gasification plants (BP Chemicals) is within Greengauge – 3 years of process and operational experience using natural gas instead of coal to produce carbon monoxide (to go onto make acetic acid / acetic anhydride) and hydrogen (to make ammonia).

Greengauge is a small group of highly experienced and qualified engineers and would be interested in representing the client in the area of Blue Hydrogen Production from coal.

Licensors would be contacted with regard to the various technologies

- Air Separation Unit
- Partial Oxidation of Coal to syngas and onto full hydrogen production via shift conversion
- Sulphur Recovery Unit (if required)
- Ammonia Plant (if required)
- Carbon Dioxide Compression / Dehydration Injection (if required)

Greengauge would review the current available licensed technology to make an assessment on what is available and appropriate to the client's requirements. Discussions with licensors would occur so that initial production and financial information would be available to the client.

Greengauge would prepare initial documentation so that engineering contractor can be contacted to give quotations for the selected technology and feasibility / FEED studies for the plant. Greengauge would work with the FEED engineering contractor to ensure the requirements are met and timescales and costs are kept in control.

The FEED documentation would then be presented to EPC companies for quotations for the detailed engineering, procurement and construction phase of the project. Greengauge would be present during the whole EPC process representing the company and ensuring costs, quality and timescales are maintained.

Greengauge would lead the commissioning of the plant having produced commissioning procedures, training packs and operating procedures during the detailed design phase with the assistance of the licensors and some contingent of the EPC contractor.

Greengauge would be interested in remaining with the project through start-up of the asset and progress the plant to safe, reliable and profitable operation, keeping the operating and maintenance standards in place for a modern asset. Shutdown management is also within the Greengauge skill set to ensure the plant remains reliable, profitable and high integrity for the medium and long term future.

Greengauge can meet with the client via WhatsApp, Team or Zoom or if the client wishes, meet them at their home office in India to discuss the way forward for this project.

Greengauge is a small dynamic company who could start on this project immediately.