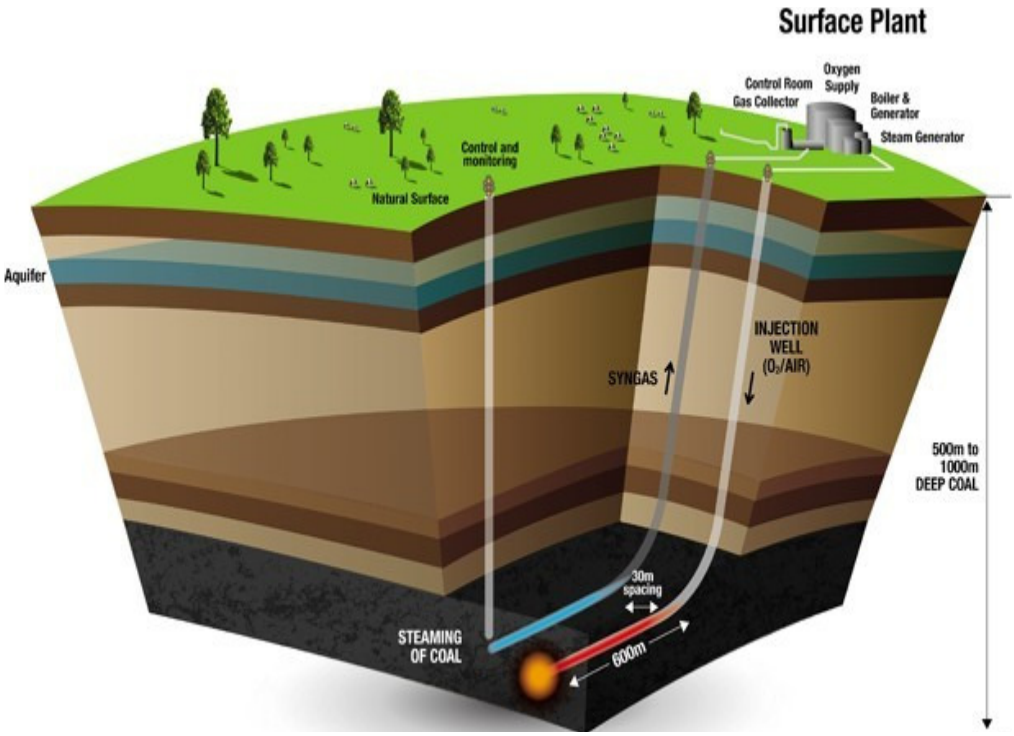


IIChE-NRC Newsletter

May-Jun 2016

UNDERGROUND COAL GASIFICATION

From Deep Within

Compiled by Hari Bajpai

December 2015 Indian government approved the coal gasification policy under which coal and lignite blocks would be allocated through auction, with revenue sharing contracts signed with successful bidders. This shows the country's commitment to use latest technologies and alternate methods to tap the potentials and the demand required to grow the nation with existing resources. Coal in India is constrained by growing land acquisition problem and stringent environmental laws. The use of coal in its present form is also not environment friendly. This is further posing pressure to move to underground coal gasification (UCG) which requires less surface area than traditional coal mining.

Underground Coal Gasification (UCG)

In UCG coal seam is gasified *in situ* under controlled combustion and resulting syngas is brought to the surface. Syngas, a mixture of hydrogen, carbon monoxide, carbon dioxide, methane and higher hydrocarbons is having great downstream utilization potential with a calorific value of 800- 1100 Kcal/m3. Syngas can be used for power generation, feedstock to fertilizers and chemical industries or can also be converted to liquid hydrocarbons.

There are several factors that determine the quality of gas produced such as coal properties, feed conditions, pressure under the coal seam, and the heat and the mass under the coal seam.

What drives the UCG

The production of coal has increased in the past few decades and is expected to surge in the future. Traditional technologies are becoming obsolete for mining coal from the majority of the reserves. Underground coal gasification has emerged as an economic and safe method to convert the unused coal across reserves.

Lower capital requirement, reduced cost of plant installation, reduced need of rail and road infrastructure, environmental obligations, and usage of deep lying coal deposit by converting them into useful products are the major drivers for the underground coal gasification market. The negative impact on environment caused by the drilling activities and the ground water contamination are the major restraints to the underground coal gasification market. The

IN THE FOLDS

emerging countries with the large coal deposits, such as India present an excellent opportunity for the development of the underground coal gasification market.

The Indian scenario

Started in 1980 with collaboration of Oil and Natural Gas Corp Ltd. (ONGC) and Coal India Ltd. (CIL) and technical assistance from USSR, underground coal gasification could not get a desirable foothold.

Under the initiative USSR experts selected 3 out of 13 coal block and finally only one was found suitable. The project was taken up by Central Mine Planning and Design Institute (CMPDI) the technical arm of CIL. Even after finding suitable, the pilot appraisal for selected block, the Metra Road Lignite Deposit could not be taken up due to concerns regarding the ground water contamination.

India has 88.6 Billion t of coal reserve occurring at depth of 300-1200 m and a further 29.6 million t of lignite reserve occurring at depth of more than 150 m. At the first appearance these would not seem technically or economically amenable for mining at present, however these provide a target area for UCG.

With the recent developments the focus is again shifting to UCG. Last year, eight Indian and foreign companies responded to expression of interest issued by CIL to partner in coal gasification projects. These included Australian Linc Energy, Lemar LLC from the US, Malaysia's Essem Group, as well as India's Reliance Power, Jindal Steel and Power Limited, GAIL India and Maheswari Group. Recently CIL invited applications from global firms for providing consultancy on formulating bid documents with regard to development of underground coal gasification projects.

Challenges before India for UCG developments

Though the major environment concern of past related to contamination of ground water aquifers with products of coal pyrolysis and ground substance can be eliminated or reduced with current technological knowledge there are other challenges as well.

Combustion Control in UCG cannot be same as in surface gasifiers. Many important process variables can only be estimated based on others instead of direct measurements.

Suitability of coal deposits depends on geological and hydrological features. In spite that UCG is feasible the actual coal deposits may very limited.

Inconsistent supply of Syngas is a constant problem as UCG is inherently an unsteady state process and production rate and heating value of syngas will vary over time.

Economies of Scale of UGC are having major uncertainties and will remain so till a reasonable number of plants are built and are in operation.

The Way Forward

India is well positioned and set to take UCG for extraction energy. With the new policies and development, government is clearly showing its interest and commitment to harness this opportunity to bridge the gap between the supply and demand of energy.

On one hand the successful trial burns and the other hand leadership of CMPDI and recent advancements in technology is making UCG an reasonable choice for future to extract energy from mines where direct mining is not technologically of economically amenable. To fully exploit potential of CCT, appropriate policy incentives and more capacity building efforts are must. An integrated inclusive growth perspective would be required in their adoption, aiming at full utilization of by-products at each stage. Different entities and stake-holders would need to work together for realization of this goal. Hence, there is a need for strategic planning to achieve clean energy infrastructure-based growth.

> "There has been a substantial increase in demand of petrochemicals in India in the last decade or so, but China has taken advantage of that as it is now supplying much of these chemicals to our country,"
> "There is no shortage of coal in India. We need to gasify it and used as raw material for producing petrochemicals. It can be a good source of energy, while for other major feedstock crude oil, we are dependent on imports"
>
> Surjit Chaudhary
> Chemicals Secretary

Resources:-

http://www.cmpdi.co.in/docfiles/coal_gasification.pdf

http://www.miningweekly.com/article/india-approves-coal-gasification-policy-based-on-revenue-sharing-model-2015-12-18/rep_id:3650

CONTRIBUTOR'S TALE

Dr Tuhin K Roy

Pioneer of Chemical Engineering in India, Dr. Tuhin Kumar Roy was born on August 1, 1923 in Monghyr, India. He completed his Master of Science, Massachusetts Institute of Technology, 1949.

He contributed as Professor and head chemical engineering Jadavpur University, 1954-1956, 58-60 and have also been Chairman of Chemical and Metallurgical Design Company Private Ltd., New Delhi.

His achievements include invention of commercialized processes for recovering nickel and cobalt from ore leach solutions and for precipitating pure nickel powder from aqueous solutions; patents for hydrometallurgy and chemical technology.

He was elected President of IIChE in 1970-71 and again in 1971-72. In his own words, "IIChE has honored me by electing me a fellow and inviting me to deliver HL Roy Memorial Lecture in 1997". This fellowship of institute was followed by the fellowship of the Indian Academy of Sciences and the Indian National Academy of Engineering. In1994, the International biographical Centre of Cambridge, England chose him to be an International man of the year in recognition of services to Chemical Engineering education, research and practice.

His life is source of inspiration for every chemical engineer in India.

IICHE-NRC EVENTS

IIChE (NRC) Lecture Series - "Learning with the Leaders" (8 Apr 2016) by Mr. Rajender Gupta

On Past Present and Future Coal - Clean Coal Technologies, describing the utilization of coal as power recourse, environmental issue with use of same, alternative and renewable energy resource and environmental regulations impacting use of coal.

IIChE (NRC) Lecture Series - "Learning with the Leaders" (8 Apr 2016) by Mr. Chandrashekhar Jain

On Capacity Enhancement of Claus Unit by Oxygen Enrichment, explaining Conventional Claus Process, The Lurgi OxyClaus® Process, Capacity Enhancement of Claus Unit by Oxygen Enrichment, Benefits of OxyClaus® Process
And
On Reducing Emissions from a Sulphur Recovery Unit, by outlining following:Reduction of SO_2 Emission, Optimization of Claus Process, Optimization of Tail Gas treatment Process, Purge Gas from Degassing recycling back to process, Emission Free SRU.

Nomination invited for executive committee election 2016 in Month of may

Upcoming events

NRC is proud to host 2nd National Council Meeting for the year 2016-2017

CHEMICAL ENGINEERING NEWS

Compiled by Karthikeyan Prakash

India ready to help revive Nagarajana oil refinery

Energy-hungry India is ready to revive projects including the Nagarjuna Oil Refinery in the south of the country to boost its oil sector. The Nagarjuna refinery, in the state of Tamil Nadu, was in an advanced stage of construction when it suffered severe damage in a cyclone in December 2011. The firm lacks the financial strength to continue work at the site.

CARB proposes 50% cut in new GHG, methane emissions standards

The California Air Resources Board (CARB) has put forth new greenhouse gas (GHG) and methane emissions standards for oil and gas facilities. The board said that the proposed rules will reduce emissions by more than 50%.

Nations commit to reductions in flaring, GHG emissions

The World Bank launched an initiative in 2015 to end routine gas flaring at oil production sites around the world by 2030. Nineteen governments, along with 20 oil and gas companies and 12 development institutions, have signed the "Zero Routine Flaring by 2030" initiative as of May 2016.

The pact seeks to curb 40% of global gas flaring by no later than 2030. It will also require governments and energy producing companies to eliminate routine flaring from new oil and gas developments.

SABIC to build a new petrochemical complex in China

Saudi Basic Industries Corp. (SABIC) has signed an agreement with Shenhua Ningxia Coal Industry Group (SNCG) to build a greenfield petrochemical complex in in the Ningxia Hui Region of China.

Global oil giants seek inroads into India's retail fuel market

Global oil majors including Saudi Aramco and Total plan to tap the retail fuel market in India, reflecting the expanding role of the world's fastest-growing large economy on the global crude landscape.

Refining technology unveiled at Honeywell UOP India center

Pilot plant designed to develop advanced hydrocracking catalysts that can more efficiently produce higher yields of clean-burning diesel fuel from crude oil.

South Korea unveils emissions crackdown to tackle smog

South Korea will introduce real-world emissions tests of diesel vehicles from 2017, and unveiled ambitious new targets for eco-friendly vehicle sales, as Asia's second-biggest diesel car market tries to tackle air pollution.

http://www.hydrocarbonprocessing.com/
http://www.worldoil.com/
http://www.gasprocessingnews.com/

STUDENT'S CORNER

Things to Remember

by Karthik

Line Sizing

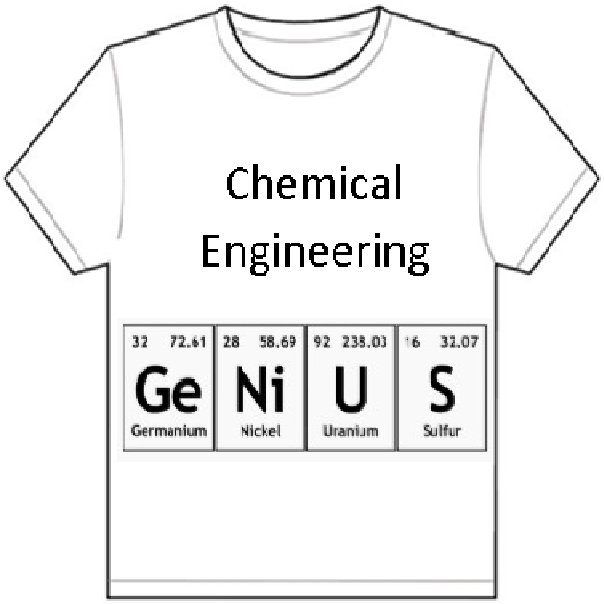
The trade-off between the investment costs for pipes and the energy costs to transport fluids to overcome the pressure drop in the piping due to friction loses, determines the line sizing in unit. The criteria for line sizing are pressure drop/ 100 ft equivalent and velocity limits.

For different pipe services say gravity, boiling, vacuum, pump suction different pressure drop/100 ft equivalent criteria are used. In some cases maximum velocity criteria are used due to noise, erosional or inertial limitations.

Straight pipe length is the measured pipe length. The frictional pressure drop in valves and fittings can be expressed as equivalent straight pipe and then added to straight pipe length, to arrive at total equivalent length. Typically Cranes paper TP 410 is followed for values of Equivalent length (L/D) and resistance co-efficient (K) for valves and fittings relative to the friction factor of pipes.

T-Shirt Quote

by Hari Bajpai



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