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Flaring in the Age of Renewables

WHY PROMOTING COAL BASED METHANE NEEDS A RETHINK

In order to meet its energy requirement, India has initiated projects for the recovery of Coal Bed Methane (CBM). Unlike, wind and solar, CBM is not a renewable energy source and its recovery has serious environmental implications. At a time when India is looking forward to meet its commitment of 175GW renewable energy (also called as clean energy) by 2022, there needs to be serious debate on the environmental viability of using CBM as an energy source. This debate is important given the fact that demonstration projects have commenced in India for the extraction of CBM in India. The principle reason for the use of CBM - higher efficiency and lower capital cost - does not account for the environmental impact arising out of such use specially the impact due to flaring, leakage and fugitive gas. More importantly, CBM extraction would divert focus from renewables to an ecologically unsustainable energy source which would be contrary to India's commitment under the Paris Agreement.

Extracting CBM

Coal-bed methane (CBM) is the methane which is produced between coal seams, where methane is held by adsorption, i.e. the process of accumulation of gases, liquids, or solutes on the surface of a solid or liquid. CBM is defined as gas that is extracted from intact coal seams. Although CBM volumes can vary from one coal seam to another, greater volumes of CBM are generally found in the higher-ranking coal reserves, such as bituminous coal as opposed to low quality sub-bituminous coal and lignite found at shallower depths (Sansom, 2005).

According to the Director General of Hydrocarbons (DGH), Ministry of Petroleum and Natural Gas (MoP&NG), a total of 710.39 - 948.73 billion cubic meter of CBM reserve is there In India, which is spread across the four states of West Bengal, Jharkhand, Madhya Pradesh and Gujarat. A demonstration project is being executed at the Moonidih and Sudamdih coal mines of Jharia coalfield for the recovery of CBM. The recovered gas will be used in vehicle refuelling and electric power generation, as stated by Central Mine Planning & Design Institute Limited (CMPDI).

CBM is being considered as an ideal fuel for co-generation power plants to bring in higher efficiency and is preferred fuel for new thermal power plant on count of lower capital investment and higher operational efficiency. However, according to a claim made by CMPDI, on the basis of predicted per day recovery from the identified blocks, possible power which can be generated in Jharkhand State is only 800 MW (CMPDI).

Extraction of CBM involves drilling down into coal seams and subsequent pumping out of the groundwater, so that the resultant drop in pressure is sufficient for methane held within the coal, to be released. Occasionally, CBM extraction may need to be enhanced by hydraulic fracturing due to insufficient natural permeability within the coal (Llewellyn, 2012).

Key Concerns

The hydraulic fracturing has proven to be an established technology; however, concerns have been expressed that the extraction of unconventional gas through this process may be detrimental to both the environment and local communities. The key areas of concern include the volume of water used for hydraulic fracturing; the risk of water contamination from this process; the emissions associated with unconventional gas; and the risk of seismic activity.

Process Related Emission of Air Pollutants

Emissions have been identified from the following source groups, which includes

- Mobile machinery used for drilling and hydraulic fracturing operations
- Compressors used to capture and transport gas
- Venting and flaring
- Fugitive emissions
- Transport of materials to and from the site

Emissions from these sources however will vary on a site by site basis. Some sources may be intermittent, and others more continuous. Sulphur compounds from drilling and flaring, organic compounds from chemicals added to hydraulic fracturing fluids, secondary PM from oxidation of NOx and Non-methane Volatile Organic Carbon (NMVOCs) and Ozone are some of the potential air pollutants which are likely to occur from various processes (Anon, 2018)

Flaring and Venting

Flaring is the practice of burning gas that is deemed uneconomical to collect and sell. This practice of flaring of gas and/or its incomplete combustion generates air pollution. Methane (CH4), NMVOCs, Particulate Matter (PM) and various forms of Nitrogen Oxides (NOx) may also be released through flaring or venting in certain circumstances (Anon, 2018).

Flares emit a host of air pollutants, depending on the chemical composition of the gas being burned and the efficiency and temperature of the flare. Venting and flaring of gas is a great concern to local residents adjacent to CBM developments owing to the release of harmful gases.

In case of Indian scenario, an EIA report for Jharia CBM block recovery however claims that development of drill site, operation of DG sets and gas compressor engine and vehicular movement are the main causes of air pollution, as they will carry occasional gas flaring following all statutory norms viz. OMR 1984, OISD guidelines (Anon 2015).

Methane Emissions

Methane is released as a "fugitive" emission during the drilling and production of both unconventional and conventional wells, and as part of the processing, transportation and storage of the gas. Fugitive methane emissions associated with development of natural gas from conventional wells is 1.7 to 6% of the methane produced over the lifecycle of a well. And the fugitive methane emission from shale formations is 3.6 to 7.9 % of the methane produced over the lifecycle of a well (Howarth et al 2011).

Extent of the problem

Absence of Regulatory Regime in India

In India, the pollution problem associated with flaring is being clubbed with the absence of any regulatory regime. India lacks any regulatory framework to deal with the various sub-components which are the part of CBM extraction. Though the CBM extraction process comes under the purview of EIA Notification 2006 (Category 1b: Offshore and Onshore Oil & Gas Exploration, Development and Production), the Standards for Liquid Effluent and the Guidelines for Discharge of Gaseous Emission[1] mandated for Oil Drilling and Gas Extraction Industry is not sufficient to cater to the need of CBM extraction process.

The above Guidelines for Gaseous Emission only talks about the specification for Diesel Generator sets and flaring station structures and stack height for elevated flaring; however the said Guideline does not deal with pollutant specific emission standard. Neither had it specified any guideline for siting criteria for carrying out venting and flaring activities nor had put a cap on maximum volume of gas that can be allowed to be vented.

In Alberta, venting of gas is allowed in those cases where the volumes of gas are insufficient to burn; Well test or maintenance venting is also not allowed within 500 metres of a residence, unless the resident gives consent. Here in Alberta, flaring is also allowed only if the volume of gas is not sufficient to make piping economic, which in the case of CBM could take several months.

In absence of such specification, the proponent of the CBM extractive unit in India are required to undertake only two mitigation measures (Box 1).

Box 1

EIA Studies for the Development of CBM Activities in Jharia CBM Block

Key Mitigation Measures

- Flaring will be undertaken in accordance with the CPCB Guidelines for Discharge of Gaseous Emissions for Oil & Gas Extraction Industry
- High combustion efficiency, smokeless flare/burner will be used

It is worth mentioning here that, small-scale activities related to the exploration of shale gas in countries like Poland, France, Germany and Sweden are already subject to European Union (EU) and national laws and regulations, such as REACH and directives on habitats, mining waste, water and hydrocarbons and as such there are no major gaps in EU environmental law when it comes to regulating the current level of activity (Llewellyn, 2012).

In UK also, shale gas exploration and production should be accompanied by careful monitoring and inspection of GHG emissions relating to all aspects of exploration, pre-production and production. A similar conclusion can be reached regarding air quality pollutants and ozone precursors, in that monitoring is required to evaluate emissions which have the potential to impact on human health, ecosystems or ozone formation (Anon, 2018).

1 Rule 14 of Environment (Protection) Rules, 1986

Requirement of Larger Spread of land

CBM wells are generally less productive as compared to conventional gas wells and therefore, firms may seek to ensure extensive, contiguous mineral leases for CBM development upon which they can drill enough wells to make a project economical. Since it may take as many as 10 to 20 CBM wells to extract the same amount of gas produced by two or three conventional gas wells, such extensive mineral leases could potentially translate into widespread surface disturbance in an area (Sansom, 2005).

In a country like India with prevailing conflicts in the related field of land acquisition, CBM exploration might turn out to be another economic burden, instead of proving to be beneficial.

Recommendation

There are serious regulatory gap with respect to CBM in India. There is a need for a specific EIA manual and guidelines for CBM which should take into account all the key concerns with respect to CBM extraction. Most importantly, the requirement of EIA Study to consider alternatives as well as 'no project' option needs to be undertaken seriously with respect to CBM, given its large ecological footprint. Specifically, the following measures may be considered:

1. Every effort should be made to avoid or minimize the venting of methane into the atmosphere. This reduction would protect air quality and minimize greenhouse gas emissions, since methane is far more potent than CO_2 as a greenhouse gas. With rapidly increasing number of CBM wells, venting even a small volume (as we do not have any specific data on how much venting of Methane Vs flaring of CO_2 is in place at present) of methane at each well will increase methane emissions and make it more difficult for India to meet its commitment of greenhouse gas reduction targets, made in Paris Agreement.
2. Adoption of new technologies to avoid venting should be a priority in first place in order to avoid any release of methane in to the atmosphere.
3. Detailed characterisation of the flaring stack emission to determine the concentration of various primary and secondary pollutants which are likely to be generated from flaring process
4. Formulation of standard for each pollutant, generating from flaring stack emission

Conclusion

It is important to understand that, in an era of moving towards renewable energy, do we need to promote another carbon intensive energy source?

As per the commitment made in Paris Agreement, India is now committed to move towards renewable energy (also called as clean energy) in order to meet its greenhouse gas emission targets. The commitment foresees 175GW of renewable energy by 2022, which includes wind energy, solar power, hydropower, biomass energy and nuclear power and not something like coal bed methane to promote gas based energy. Increasing gas-based electricity generation, fuelled by abundant unconventional gas, could discourage investment in low-carbon technologies and thus further contribute to the air pollution.

NOTES

1 Hydraulic fracturing is a process that serves to open up the coal seams and help release the CBM from the formation. Fracturing is usually achieved by pumping a fracturing fluid or inert gas (i.e., nitrogen or carbon dioxide (CO2)) into the coal seam at pressures sufficient to crack open the cleats within the coal enabling the gas to more easily flow to the well.

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