THANJAVUR DISTRICT

Executive Summary

Exploration, testing of wells and commercial exploitation of Mannargudi CBM Block, MG-CBM-2008/IV, Thiruvarur & Thanjavur Districts, Tamil Nadu

September 2011
Executive Summary

A. Project Description

1. The Project Proponent

Great Eastern Energy Corporation Ltd., hereinafter referred to as ‘GEECL’, is the first Private Sector Company in India to have entered the field of Coal Bed Methane (CBM) exploration. It is part of the YKM Holdings Group. In December 2005, GEECL also became the first Indian Company to be listed on the London Stock Exchange's Alternative Investment Market (AIM). In May 2010, Global Depository Receipts (GDRs) of the Company were admitted to the main market of the London Stock Exchange.

GEECL has started commercial production of Coal-Bed Methane (CBM) and its utilization for the first time in India, near Asansol, in the Burdwan District of West Bengal, where it is currently exploring and developing production wells in the Damodar Valley (at the Raniganj Coalfield). This field covers an area of 210 km². Current estimates of the Gas-in-Place at the Raniganj field amount to reportedly two Trillion Cubic Feet (TCF).

GEECL’s pioneering effort is helping maintain the ecological balance in coal bearing areas where methane gas is escaping into the atmosphere and damaging the ozone layer. It will result in the demethanation of coal-beds and avoidance of methane emissions into the atmosphere.

GEECL now is in the process of initializing exploration activities at its second CBM Block near Mannargudi, in Tamil Nadu, the subject of this study.

2. Project Background

The Mannargudi CBM block forms a part of lignite basin in the coastal tracts of Tamil Nadu and Pondicherry in the Cauvery Basin. The linear lignite belt extends from Bahur in Pondicherry through the Neyveli Lignite Mines, to Srimushnam Jayamkondacholapuram, to the Mannargudi area, further south. The lignite belt has been explored systematically through core hole drilling by various agencies, which proved the occurrence of very thick lignite seams of tertiary age at a relatively shallow depth. The lignite resources of Mannargudi were proven to occur over a large area of more than 760 km² where the seams occur at a variable depth of 150 m to 500 m. The Directorate General of Hydrocarbons (DGH), at the Ministry of Petroleum and Natural Gas (MoPNG), based on a preliminary survey, made a broad assessment of the CBM potential of vast concealed resources of lignite, and decided to explore the area for possible future production of CBM.

Under the CBM-IV licensing round in June 2010, MoPNG awarded the Mannargudi Block to GEECL. The Mannargudi block (as delineated by the DGH) covers an area of ~691 km² whilst the effective area for CBM operations is ~667 km² (~66,700 hectares), leaving aside an area of ~24 km² for possible lignite mining in the future. The estimated Gas-in-Place in the effective area as per the DGH is 0.98 TCF.

3. Location of CBM Block

Block MG-CBM-2008-IV is geographically located in Thiruvarur and Thanjavur districts of Tamil Nadu.

Tiruvidaimarudur, Kumbakonam, Orathanadu and Papanasam Taluks are covered in Thanjavur district.

4. Proposed Project

GEECL has proposed for the exploration, testing of wells, and commercial exploration & exploitation of Mannargudi CBM block. Following activities will be carried out during proposed project:

- Drilling of 50 core holes and two test wells during Phase I
- Drilling of 30 test wells including two test wells drilled earlier in Phase IIA.
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Tentative locations of 12 core holes falling in Thanjavur District is given below in table - I and balance 38 core hole locations falls in Thiruvarur District.

Table - I

<table>
<thead>
<tr>
<th>Core hole No.</th>
<th>Latitude (N)</th>
<th>Longitude (E)</th>
<th>Location Details</th>
</tr>
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<tbody>
<tr>
<td><strong>Thanjavur District</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH-1</td>
<td>10°54’26.58&quot;N</td>
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<td>10°54’6.54&quot;N</td>
<td>79°29’50.58&quot;E</td>
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<td>10°54’5.82&quot;N</td>
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<td>79°27’30.12&quot;E</td>
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</tr>
<tr>
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<td>10°56’5.10&quot;N</td>
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<td>CH-32</td>
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<td>10°54’49.08&quot;N</td>
<td>79°26’59.04&quot;E</td>
<td>Natchiarkoil village, Kumbakonam Taluk</td>
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<tr>
<td>CH-45</td>
<td>10°40’8.76&quot;N</td>
<td>79°18’36.90&quot;E</td>
<td>Kulamnagalam village, Orathanad Taluk</td>
</tr>
</tbody>
</table>

Location map of core hole falling Thanjavur District is shown in Drawing No. M-2.1/B.

Approximately 1.5 – 2 acres of land shall be required for core hole and test well. Land shall be acquired on lease / permanent basis on need basis at the prevailing market price from the private owners. No forest / govt. land shall be acquired.

None of corehole / test well locations fall in forest land, near temples / monument of archeological interest.

Core hole drilling operations do not involve extraction of any hydrocarbons whatsoever. CBM test well drilling operations involve low pressure conditions (as compared to conventional oil and gas drilling operations) and do not have a history of blowouts at the drilling depths proposed for this Block. A distance of 1.5 km from habitation is not feasible owing to compelling geophysical / logistic and technological limitations. Considering the same, a minimum distance of 100 m from habitations has been considered for core hole drilling in line with the GEECL experience as well as permissions received from the MoEF for the GEECL Raniganj (south) CBM Block in West Bengal.

No Forest Land is proposed to be used for the project. Based on both GEECL and Kadam’s interaction with the Forest Department, no forest land exists within the Block Area.

The area does not contain significant available land other than revenue land and consequently revenue land will require to be used for the project. However, all efforts have been made to site the wells away from productive agricultural land and instead use fallow land.
5. **Work force Management**

During drilling operation in exploration and pilot assessment phase about 15 to 20 persons may be working at site at time.

6. **Power Requirement**

Diesel engines shall be utilized to supply necessary power during drilling operation; following would be the power requirement:

- 250 HP power will be required for operation of Rig and 20 HP for Mud pump during core hole drilling and
- 760 HP power will be required for rig during test well drilling if Air drilling is employed, in addition to this 20 HP power will be required for mud pump if mud drilling is used.

HSD will be used as fuel in DG sets.

7. **Water Requirement**

Water requirements can be divided into requirements for drilling activities as well as drinking and sanitary (i.e. domestic) requirements.

- Raw water requirement for drilling core holes is estimated to be ~11 Kilolitres\(^2\) (KL) for the entire drilling period. The total period for drilling operation shall be 10-15 days.
- Use of drilling mud will consume up to 67 KL of water per test well, using mud based drilling applications and a slightly lower figure (~56 KL per test well) for air drilling applications.

Water requirement for CBM operations is largely limited to the duration of drilling operations only, with additional limited water supply to cater to domestic requirements of the workforce at base camp(s). Water supply would be sourced from either:

- a. Purchase from Private tankers; or
- b. ground water sourced at base camps, located in Mannargudi or Orathanadu Taluks. These Taluks are categorized as Safe Taluks by the Central Ground Water Board (CGWB) from ground water perspective for which no permission of CGWA is necessary.

8. **Waste Water Generation and Disposal**

During drilling operations ~8-10 KL of waste water will be generated per core hole and up to 52 – 55 KL and 62-65 KL of waste water will be generated for each test well using air drilling and mud drilling techniques respectively. This wastewater will be stored at site in High Density Polyethylene (HDPE) lined pits of sufficient size and allowed to dry in the sun. To the extent feasible available local homesteads with existing toilet facilities would be rented for rest and sanitary requirements of workers. In case this is not feasible, domestic waste water (~2.3 KLD) will be discharged through a septic tank / soak pit system.

9. **Air Emissions**

The emissions to the atmosphere from the CBM drilling operations shall be from the DG set used for power generation and due to flaring operation during test well drilling. In accordance with the Oil Mines Regulation Rules, 1984, a flare stack of sufficient height will be provided. Duration of flaring will be short and there will be provisions to shut-off the test wells by stopping the pump.

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\(^1\) One kilolitre equals 1,000 litres
10. Solid and Hazardous Waste Management

Various types of solid wastes generated during the drilling would include drill cuttings, cardboard, papers, scrap metal, packaging material, and plastics.

It is estimated that maximum of 6.5 tonnes drill cuttings per core hole and 10.5 tonnes drill cutting per test well will be generated in the form of solid waste during the drilling. Drilling cuttings separated from mud will be properly washed and unusable drilling fluids will be disposed off in on-site disposal pit lined with impervious HDPE liner. Drill Cutting will be tested for oil and grease (O&G) content and if O&G found more than 10 mg/kg it will be sent to final disposal at TNPCB approved site in nearby location.

About 30-35 liters of used oil will be generated during drilling of one core hole and 60-70 liters used oil will be generated during drilling of one test well. Used oil will be generated at will be sold to approved recycler of CPCB / TNPCB.

B. Description of Environment

Baseline environmental studies were carried out during summer season of year 2011. The study area is considered to be the area within a radius of 10km from the CBM block.

1. Land use of the Study Area

A recent satellite image for the study area was collected using Google Earth Pro. The image was interpreted for identification of various land usage. Land use of study area is broadly classified into categories such as agriculture, habitation, land with shrubs, land without shrubs, water bodies, Industrial area, Sandy area, Mud flats, and River bed area. The predominant landuse is agriculture.

2. Proximity to Sea / Water Bodies

The block is not in the close vicinity of sea. Major water bodies in block are Cauvery River, Vettar River and Vennar River and their tributaries.

3. Climate

The climate of this region is essentially tropical. Temperatures and humidity remain relatively high all year round. Winter falls between November-February. The period from March to May is recognized as summer season, rainy season is between October to December during which north east monsoon brings monsoon to the area.

Thanjavur District

Mean average temperature recorded for summer season was 31.8°C with mean maximum temperature of 37.7°C and mean minimum of 28.6°C.

The mean average humidity recorded was 63.2% with mean maximum humidity of 71.0% and mean minimum of 50.2%.

Predominant wind direction during study period is observed to be from WNW and WSW directions.

Mean average wind speed was observed to be 2.3 km/hour.

4. Ambient Air Quality

Ambient air quality monitoring was carried out during summer season 2011. The ambient air quality monitoring stations were set up at 50 different locations within one kilometer of each core hole location as per the requirement of Terms of Reference issued by MoEF.
Average concentration of PM$_{2.5}$ at various locations was observed to be varying from 16 to 25 µg/m$^3$ and PM$_{10}$ was observed to be varying from 32 to 61 µg/m$^3$.

Average concentration of SO$_2$ at various locations was observed to be varying from <8.0 to 8.3 µg/m$^3$ and NO$_x$ was observed to be varying from <10 to 15.6 µg/m$^3$.

Average concentration of HC was observed to be varying 1010 - 1557 µg/m$^3$

VOC's are observed to be below 0.25 mg/m$^3$.

5. **Groundwater Quality**

Groundwater samples were collected from 19 different locations within the study area, in the following villages namely Vadakaravayali, Kilvandesari, Koradachery, Kottaiyur, Rayapuram, Kannandangudi, Puvanur, Serumanallur, Sellur, Manjakudi, Kilvadayal, Kodavasal, Puruttiyur, Nachchivarkoil, Tukkachi, Paundarikapuram, Vettur, Aduturai and Kadiramangalam Village.

Analysis of samples revealed that almost all parameters are generally below the permissible limit specified for drinking water as per IS: 10500 at all locations

6. **Surface Water Quality**

Surface water (River and Pond) samples were collected from 17 different locations within the study area, namely Pond at Mannargudi, Vadavur, Adhanur, Perapuzzi, Naalur, and Aduturai Village and from Virasolanar River, Mudikondan River, Kodamurutti River, Sullan River, Puttar River, Vennar River, Pamaniyar River, Tirumalarajarajan River, Cholabudamani river and Vettar River.

Analysis results of the river samples revealed that Rivers can be classified as class A river i.e. drinking water source without conventional treatment but after disinfection

Analysis of sample from ponds revealed that all parameters are below the permissible limits for drinking water as per IS: 10500 at all locations except Iron content in Village pond of Perapuzzi village and total and fecal coliform at all locations

7. **Soil**

Around 81.92% usage of the land in the study area falls under agricultural land category. Soil samples were collected from 16 different locations within the study area namely, Savalakkan, Poovanur Village, Paruthikottai Village, Kulamangalam Village, Muvarkottai, Serumanallur, Koradachery, Muttur, Sembangudi, Kandramanikkam, Ammangudi, Aduturai, Kadiramangalam, Kunthangudi, Sangli Puram, Adanur Village. The texture of soil is observed to be Sandy Clay Loam in the study area based on analysis of the samples collected.

8. **Noise**

Noise levels were recorded at 20 different locations within the study area namely, Melapalaiyur, Maluvechery, Thirucherai, Kottaiyur, Atthikadi, Ogai, Vadavur, Aduturai, Needamangalam, Kudavasal, Mannargudi, Koradachery, Nachchivarkoil, Vadavur Village, Alangudi Village, Adanur Village, near Well CH-22, Valangaiman, Kuhur Village. Comparison of the ambient noise levels with the standards specified by CPCB reveals that the noise level at all locations is below the specified limit both during day time & night time except at Noise level during day time at Kuhur Village, Alangudi Village, Vadavur Village, Nachchiyarkovil Village, Koradachery Village, Kudavasal, Nidamangalam, and Aduturai

9. **Demographic and Socio-Economic Profile**

Analysis of the demographical statistics, based on Primary Census Abstract, 2001 reveals that there are a total of 254 villages in the study area of having a population of 7, 87, 548 and 1, 77, 431 dwelling units.
Scheduled castes constitute about 21.22% of the total population and Scheduled tribes constitute about 0.12% of the total population for various taluks covered in the study area. Villages in the study area have fairly good infrastructure facilities. Over all literacy rate is about 65.96%.

10. Flora and Fauna

Information regarding floral species and fauna in the study area is gathered from Site Visits.

The terrestrial as well as aquatic flora includes most of the common plants species; however fauna also include mostly schedule IV or common species which are observed commonly throughout the study area.

Coconut tree (Cocos Nucifera) was dominant floral species in the study area where as Jungle crow (Corvus macrohynchos) and common Kingfisher (Alcedo atthis) were common faunal species in the study area.

The nearby vaduvur bird sanctuary with also include common migratory and local or residential birds species.

C. Anticipated Environment Impact and Mitigation Measures

1. Ambient Air

Emissions from the Diesel Engine and D.G Sets were analyzed for their impacts on the ground level concentration (GLC) at various distances using the dispersion modeling guidelines given by the Central Pollution Control Board, New Delhi and the Industrial Source Complex Short Term Model (ISCST3) of the United States Environment Protection Agency (USEPA) as follows:

Maximum 24 hourly average GLC’s are observed to be 5.09 µg/m$^3$, 2.4 µg/m$^3$ and 0.102 µg/m$^3$ for SO$_2$, NOx and PM respectively at distance of 90m from the source in ESE Direction.

The predicted impact level due to the flaring operation and operation of Diesel Engine is within the prescribed limits of CPCB for the ambient air quality and is expected to be insignificant on the nearby population.

2. Water

Impact on water resources

Drilling operations require the use of water for domestic requirements as well as for operations, Water requirement for CBM operations is largely limited to the duration of drilling operations only, with additional limited water supply to cater to domestic requirements of the workforce at base camp(s). Water supply would be sourced from either:

a. Purchase from Private tankers; or

b. ground water sourced at base camps, located in Mannargudi or Orathanad Taluks. These Taluks are categorized as Safe Taluks by the Central Ground Water Board (CGWB) from ground water perspective for which no permission of CGWA is necessary

Impact on Water Quality

Wastewater discharged from the drilling/other operations will be collected in HDPE lined collection pit & would be disposed off as per the prescribed norms specified by TNPCB.

To the extent feasible available local homesteads with existing toilet facilities would be rented for rest and sanitary requirements of workers. In case this is not feasible, domestic waste water (~2.3 KLD) will be discharged through a septic tank / soak pit system.
3. Land

Pre Drilling Site preparation

The existing land and land use pattern will get affected from the construction of drilling site and associated activities, like installation of rig & machineries, temporary storage of domestic waste and other kind of waste material etc. These impacts may happen in terms of temporary clearing of site area, changes in the aesthetic looks of the area, changes in soil characteristics from temporary dumping of earth and fill material required for site elevation etc.

Drilling of Wells

The entire drilling operation, being a temporary activity, will not require any kind of land acquisition (as it involves temporary leasing of land) and neither involves clearing of any trees, except few ground vegetation. During the entire drilling operation, drill cuttings and domestic waste and sewage etc may cause soil contamination if not handled properly.

The road area within the village land may get affected from heavy vehicular movement. This truck movement is likely to cause traffic congestion in the village level road for short duration of time.

4. Noise

The source of noise generation is due to operation of rig, diesel-generating sets and certain pumps operating for mud circulation. The noise level is well below the specified limits. The impact of noise generated by drilling on the near-by population is expected to be insignificant.

5. Flora and fauna

Impact of flora & fauna due to air, water and soil pollution caused by the project is ruled out due to the limited and temporary nature of drilling activities.

6. Socio Economic

The proposed activities shall generate indirect employment in the region, which would marginally improve the economic status of the people. The project would lead to improvement in transport facilities. In the event that commercial quantities of hydrocarbon reserves are discovered, more long-term employment opportunities would be generated. Besides, the hydrocarbon brought to the surface shall help in contributing the ongoing efforts of the government to meet the national demand of petroleum resources.

The risk of occupational hazards such as personal injuries, accidents during installation and operation will be very less since safety measures will be adequately implemented by GEECL.

No adverse impact is expected on sanitation and community health.

D. Project Benefits

CBM gas is an eco-friendly natural gas stored in coal seams, generated during process of coalification. CBM gas exploration and exploitation has an important bearing on reducing the greenhouse effect and preventing the direct emission of methane gas into atmosphere due to open cast mining.

The extraction of CBM gas reduces the risk of fire during coal mining in future if any.

Methane is a very powerful source of energy and eco-friendly. It is better substitute of Petrol and diesel as it produces 70% less carbon monoxide, 87% less nitrogen oxide than petrol and diesel. It also exhausts 89% less biogas in comparison to petrol and diesel.
Great Eastern Energy Corporation Limited

In case of successful recovery of economic quantity of CBM gas central and state government would have royalty benefits as per the production sharing contract.

The extraction of CBM gas will contribute for generation of primary employment for various activities associated with CBM drilling like site preparation, preparation of raw material, and various other activities.

Local skilled and unskilled labour would get their skilled enhanced through exposure to drilling technology.

Generation of secondary employment for various support facilities like supply of raw material, fuels, chemicals, other ancillaries material for drilling activities.

Extraction of CBM gas will reduce dependence on imported of petroleum product to meet the energy requirement.

E. Environment Management Plan

The EMP provides a delivery mechanism to address potential adverse impacts, to instruct contractors and to introduce standards of good practice to be adopted for all project works. For each stage of the programme, the EMP lists all the requirements to ensure effective mitigation of significant biophysical and socio-economic impacts identified in the EIA. The EMP covers the following:

- Role of GEECL and its contractors;
- A comprehensive listing of the mitigation measures (actions) that GEECL shall implement;
- The parameters that shall be monitored post project to ensure effective implementation of the action;
- The timing for implementation of the action to ensure that the objectives of mitigation are fully met.

F. Additional Studies

Consequence Analysis

Hazards are identified for release of Methane from pipeline and release of HSD from storage tank and storage drum at drilling site. Consequence analysis of all possible containment scenarios was carried out using DNV Technica Software (PHAST).

Results of Consequence Assessment

The results of consequence assessment indicate that the risk contours for fatality are confined within the drilling site only.