Coal Bed Methane
Prospecting Using Remote Sensing & GIS

Prepared by

[Image of a hammer and geological samples]

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Coal Bed Methane Prospecting

Introduction
Coal Bed Methane (CBM) is a natural gas generated during the coalification process and stored in coal seams, in the adsorbed state, on the internal surfaces of coal matrix. The ability of coal to store methane gas is dependent on multiple factors, the primary being the rank and depth of coal.

CBM exploration experience reveals that coal seam and sand reservoir can hold 5 - 6 times the amount of gas as compared to gas stored in conventional sand reservoirs of compatible size. The exploitation and production of CBM is dependent upon the permeability (hence fracture density) of coal and on the coal bed thickness and its rank.

Modern technologies such as GIS and remote sensing can be effectively used to catalyze the process of location and exploration of methane gas reservoirs.

RMSI Services
- Preparation and updation of the geological maps using satellite images and existing maps
- Creation of digital data base for lineament patterns using satellite imagery
- Fracture density mapping and evaluation of possible fair way zones of CBM pathways
- Mapping hydrological features using remote sensing satellite images
- Detection of igneous intrusive bodies and their impact on CBM coals
- Interpretations of other thematic layers such as geomorphology and litho contrasts
- Geospatial (GIS) analysis of geological and other related parameters for CBM existence
- Delineation of favorable CBM extraction locales based on integration of GIS, remote sensing and other related studies
- Zonation of areas in a grid pattern with possible ranking

Methodology
RMSI uses a combination of GIS, remote sensing based satellite data of suitable resolution, secondary data (geological and other data collected from topographical maps), and limited ground validation of structural, stratigraphic and geological information for preparation of various input layers for GIS modeling and coal bed methane zonation.

Using a combination of these techniques ensures that projects are completed within a very short turnaround time, as compared to traditional ground based approaches, while maintaining high accuracy levels.

Creation of the various layers needed for mapping and delineation of favorable CBM sites require intelligent interpretation of satellite images, mapping and updation of geology and geomorphological information, and preparation of multiple GIS layers. Key steps include:

- **Ground Truth Collection**
  As per the requirement, scale and magnitude of the study, the RMSI team comprising remote sensing and geological experts carry out relevant field and geological survey
**Thematic Layer Generation**

Thereafter the ground information and satellite data is used for preparation of various thematic layers such as:

- **Fracture and Lineament Map** - Using medium resolution images, the Earth structures such as faults, joints, and folds are mapped with the help of photogrammetric elements of tone, texture, and patterns.
- **Geological Map** - The geological map is updated based on the tonal variations with changing lithology in satellite image and through ground checks by our field geologists.
- **Geomorphological Map** - The geomorphological map is updated based on satellite image elements and updated with field verification data.
- **Physiographic map** - Topographical features such as drainage and contour are extracted from reference topographic maps in a GIS environment.
- **Hydro-geological map** - Hydro-geological map is prepared by integrating the ground water data and the geological data.

![Figure 1: A: Lineaments derived from Satellite image overlaid B: Fracturation density map and C: Geomorphology map](image)

**Analysis**

RMSI uses multiple GIS modeling techniques to synthesize the viability analysis. Some of these examples include - frac-explore analysis, hydro-geological analysis, impact of igneous intrusive on coal and variation of fixed carbon (FC), cumulative thickness and coal quality analysis amongst others. Finally, the above analysis results are integrated and used for delineating probable CBM potential zones.

![Analysis diagram](image)
Value Ad Service
RMSI also has the capability to undertake High Resolution Shallow Seismic (HRSS) surveys and interpret map sub-surface coal seams through its network of associated partner agencies. The fairway zones identified can be further corroborated by selective geochemical studies in the anomalous areas.

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