

# CBM field development & Challenges

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**Oil & Gas conference 'India Drilling & Exploration Conference (IDEC) 2010'**

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**Essar Exploration & Production Ltd.**

**“Building a Balanced Portfolio of International Exploration & Production Assets”**

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CBM is a game of patience and perseverance

# ***Outlines Of Presentation***



- 
- **Snap Shot Of Essar Business**
  - **CBM – Coalbed Methane**
  - **CBM Blocks in India**
  - **CBM Field Development – Essar’s RG CBM Block**
  - **CBM Field Development Challenges**
  - **Conclusion**

# Snapshot of Essar Businesses



Steel	Energy	Power	Communications	Shipping Ports & Logistics	Projects
					
<p><b>CURRENT OPERATIONS</b></p> <p><b>India</b>            •10 MTPA integrated steel plant, Hazira            •8 MTPA pellet plant, Visakhapatnam            •8 MTPA beneficiation plant, Bailadila, Chattisgarh            •Cold rolling, galvanising, colour coating plant, Pune</p> <p><b>Indonesia</b>            0.4 MTPA cold rolling Complex, Jakarta</p> <p><b>Canada</b>            4.0 MTPA integrated steel plant, Sault Ste Marie, Ontario</p> <p><b>USA</b>            1.4 billion tonne iron ore reserves, Minnesota</p> <p><b>Global network of Hypermarts &amp; Service Centers</b></p> <p><b>UNDER EXECUTION</b>            •8 MTPA pellet plant, Paradip, Orissa            •6 MTPA pellet plant, Jodha Barbil area, Orissa            •6 MTPA pellet plant, Minnesota</p>	<p><b>CURRENT OPERATIONS</b></p> <p><b>Exploration &amp; Production</b>            E&amp;P rights in valuable oil &amp; gas blocks globally</p> <p><b>Refining</b>            12.5 MTPA refinery complex</p> <p><b>Retail</b>            Over 1,200 retail outlets</p> <p><b>UNDER EXECUTION</b>            Refinery expansion to 34 MTPA in two phases</p>	<p><b>CURRENT OPERATIONS</b></p> <p><b>Hazira, Gujarat, India</b>            1,015 MW combined cycle plant</p> <p><b>Vadinar, Gujarat, India</b>            125 MW co-generation plant</p> <p><b>Visakhapatnam, Andhra Pradesh, India:</b> 25 MW plant</p> <p><b>UNDER EXECUTION</b></p> <p><b>Gujarat, India:</b>            •1,200 MW, Salaya            •890 MW co-generation plant, Vadinar</p> <p>•Wind energy plant, Bhuj</p> <p>•270 MW multifuel plant, Hazira</p> <p><b>Mahan, Madhya Pradesh, India:</b> 1,200 MW</p> <p><b>Tori, Jharkhand, India:</b> 1,200 MW</p> <p><b>Paradip, Orissa, India:</b> 120 MW coal-based plant</p> <p><b>Tirunelveli, Tamil Nadu, India:</b> 150 MW wind farm</p>	<p><b>Telecom services</b>            Vodafone Essar: Over 80 million subscribers            Yu: GSM service in Kenya, 600,000 subscribers</p> <p><b>Telecom infrastructure</b>            Over 4,500 telecom towers operational; 14 percent stake in Indus Towers</p> <p><b>Telecom retail</b>            The MobileStore: Over 1,300 outlets operational</p> <p><b>Telecom services enabled</b>            Aegis: 37,000 people in offices in the Philippines, Costa Rica, USA, Australia, South Africa, Kenya and India</p>	<p><b>CURRENT OPERATIONS</b></p> <p><b>Essar Shipping</b>            Fleet of 25 vessels,  <b>Vadinar Oil Terminal</b>            Terminal facility of 32 MTPA – Liquid Cargo, Vadinar</p> <p><b>Bulk Terminal</b>            Dry bulk port facilities, Hazira</p> <p><b>Essar Oilfields</b>            A drilling company with 13 rigs</p> <p><b>Essar Logistics</b>            Owns and operates transshipment assets</p> <p><b>UNDER EXECUTION</b></p> <p><b>Ports &amp; Terminals</b>            Vadinar, Gujarat: Increase capacity to 50 MTPA,            Hazira:, Gujarat :30 MTPA all-weather deep draft port            Salaya Gujarat: 20 MTPA integrated terminal facility</p> <p><b>Sea transportation:</b>            12 new vessels on order</p> <p><b>Oilfields services</b>            2 new jack-up rigs on order</p>	<p><b>Construction</b></p> <ul style="list-style-type: none"> <li>•Engineering</li> <li>•Procurement</li> <li>•Fabrication</li> <li>•Construction</li> </ul> <p>Fully geared to execute turnkey EPC jobs in India and overseas</p> <p>Asia's largest equipment bank</p> <p><b>Offshore Subsea</b>            Expertise in marine construction</p> <p><b>Heavy Engineering Services</b></p> <p><b>Project Management Consultants</b></p>

CBM is a game of patience and perseverance

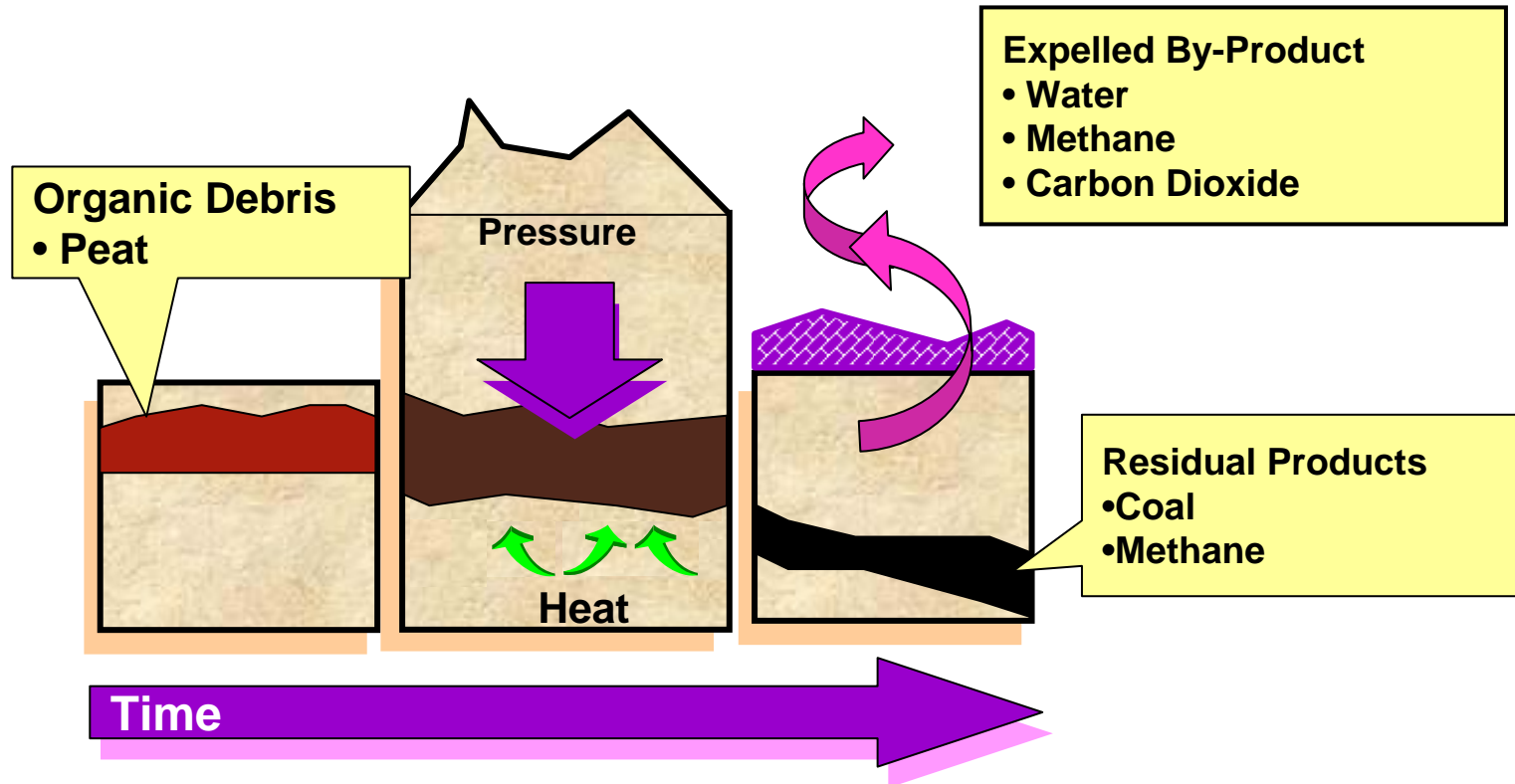
# CBM – COAL BED METHANE

- Coalbed Methane (CBM) is natural gas ( $\text{CH}_4$ ) and it occurs in coals as adsorbed gas.
- Coalbed methane is a technology play that requires reservoir understanding and appropriate technology for all phases of prospect evaluation and field development.
- CBM Explorers essentially try getting fix on the following
  - Coal thickness and coal seam continuity
  - Gas content
  - Permeability
- CBM Reservoirs is water saturated & requiring dewatering in initial phase & gas takes time to come on to the surface

*CBM therefore, is a game of patience and perseverance*



# CBM generation



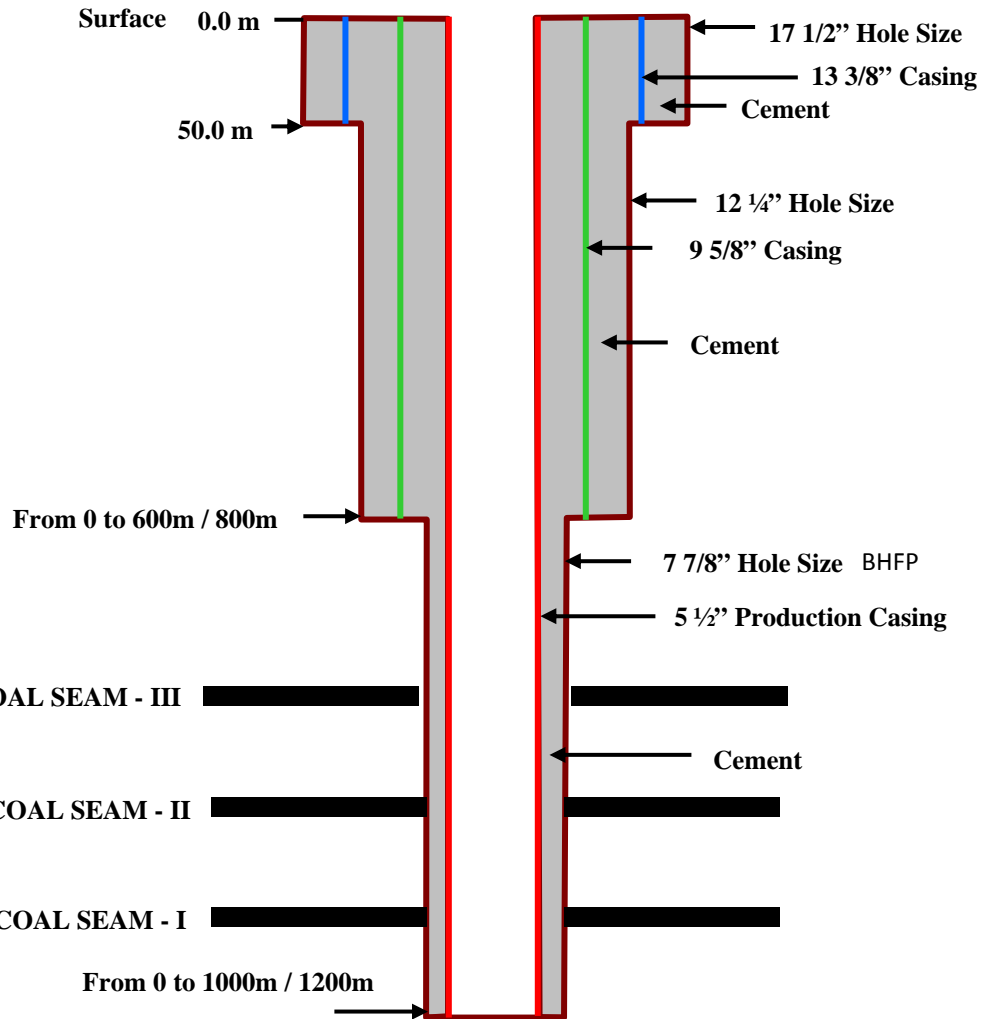
# USES OF CBM



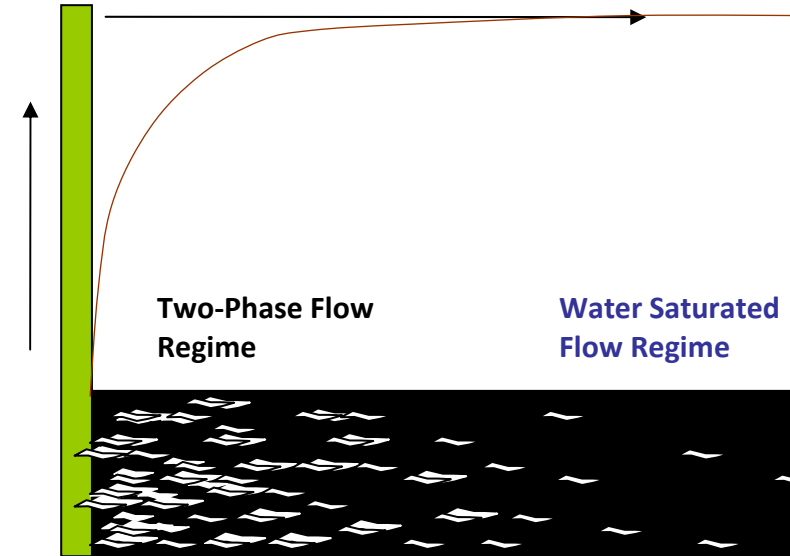
- **Power Generation** : Lower capital investment and higher operational efficiency
- **Auto Fuel** : Compressed Natural Gas (CNG)
- **Fertilizer Manufacture** : As feed stock for urea manufacture & Captive power
- **Steel Manufacturing** : Better Quality product at lower capital costs
- **Fuel for Industries** : Economical fuel for cement plants, refractory, steel rolling mills etc
- **Other uses** : Domestic and industrial supplies



# CBM Production Well Configuration

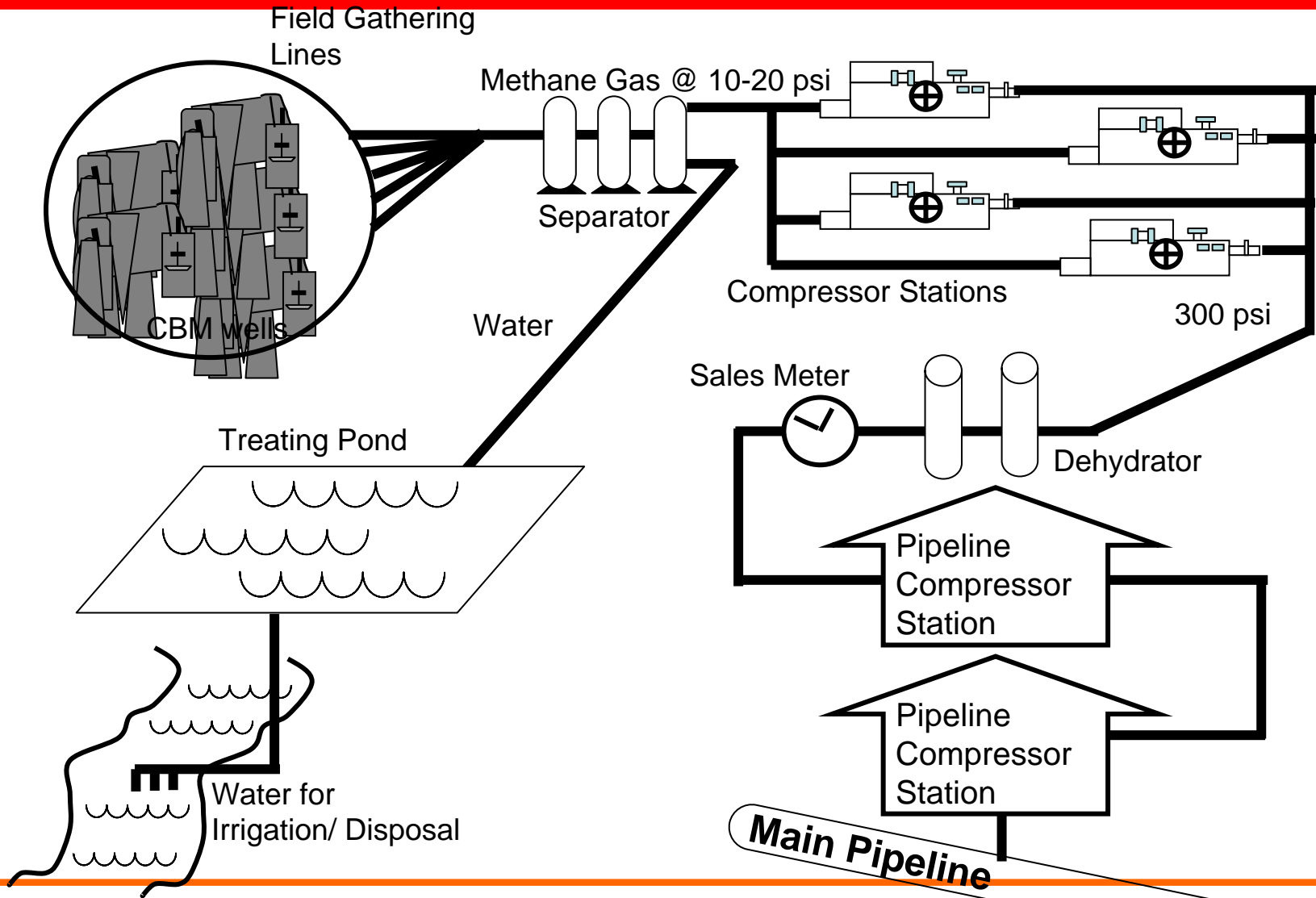


Distance From Well (Function of Time, Perm, etc)



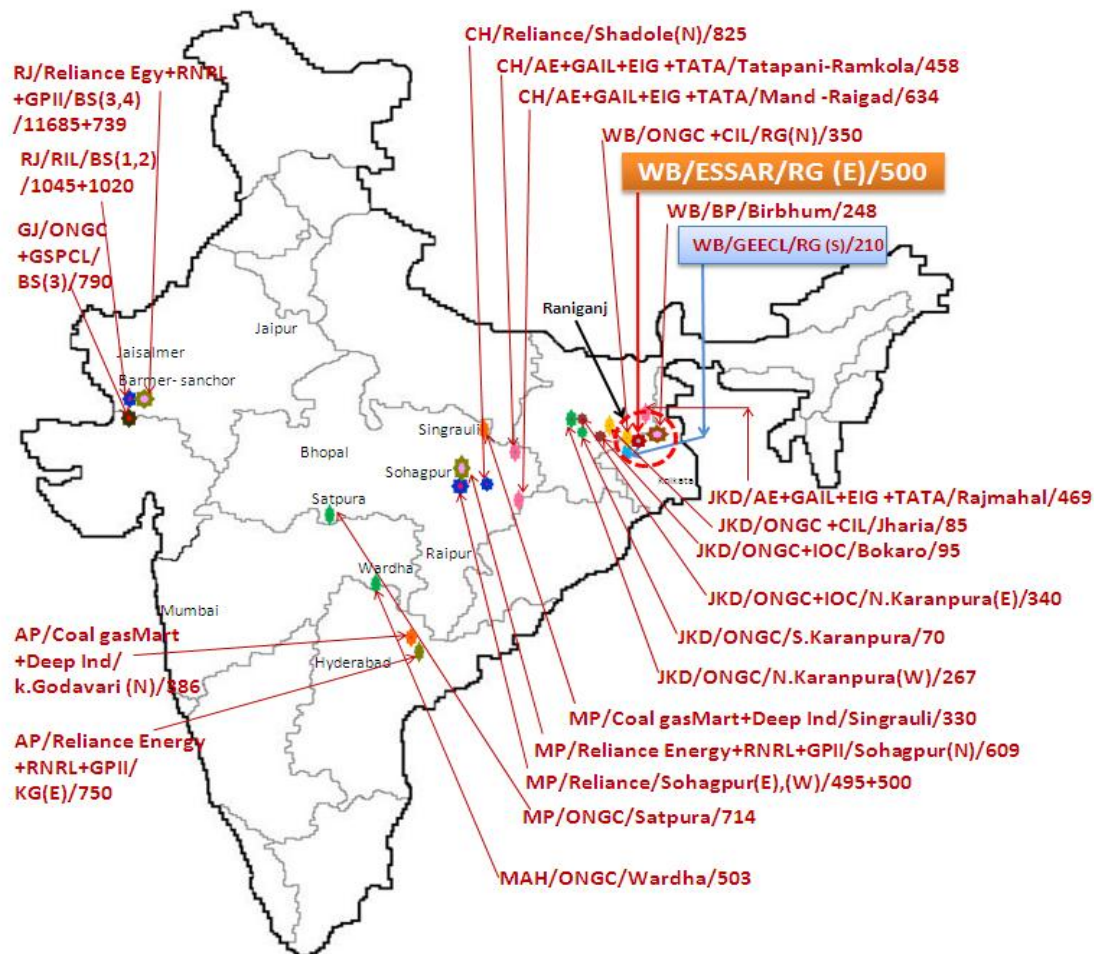
CBM is a game of patience and perseverance

# Typical Schematic of CBM Production Facility



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# CBM Blocks in India-An Overview



Eastern region presently deprived of natural gas

State	No. of Blocks	Area (Sq.Km)
West Bengal	4	1308
Jharkhand	6	1326
Madhya Pradesh	5	2648
Rajasthan	4	3972
Chhattishgarh	3	1917
Andhra Pradesh	2	1136
Maharashtra	1	503
Gujarat	1	790
<b>Total</b>	<b>26</b>	<b>13600*</b>

**Total estimated CBM potential 70 TCF**

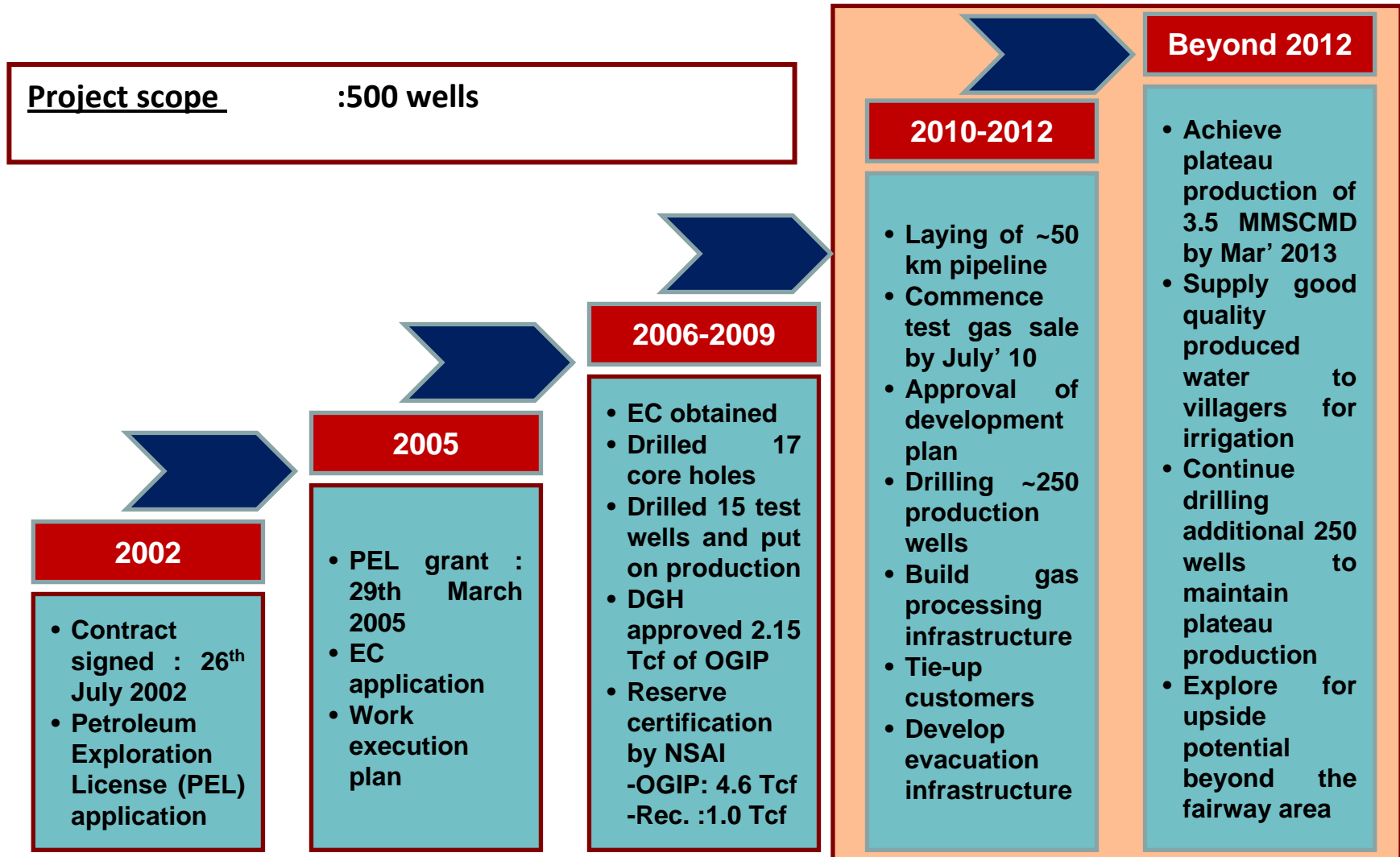
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**SOURCE :DGH,  
\*IV th round Biding not included**

***CBM Field Development-  
Essar's RG CBM Block***

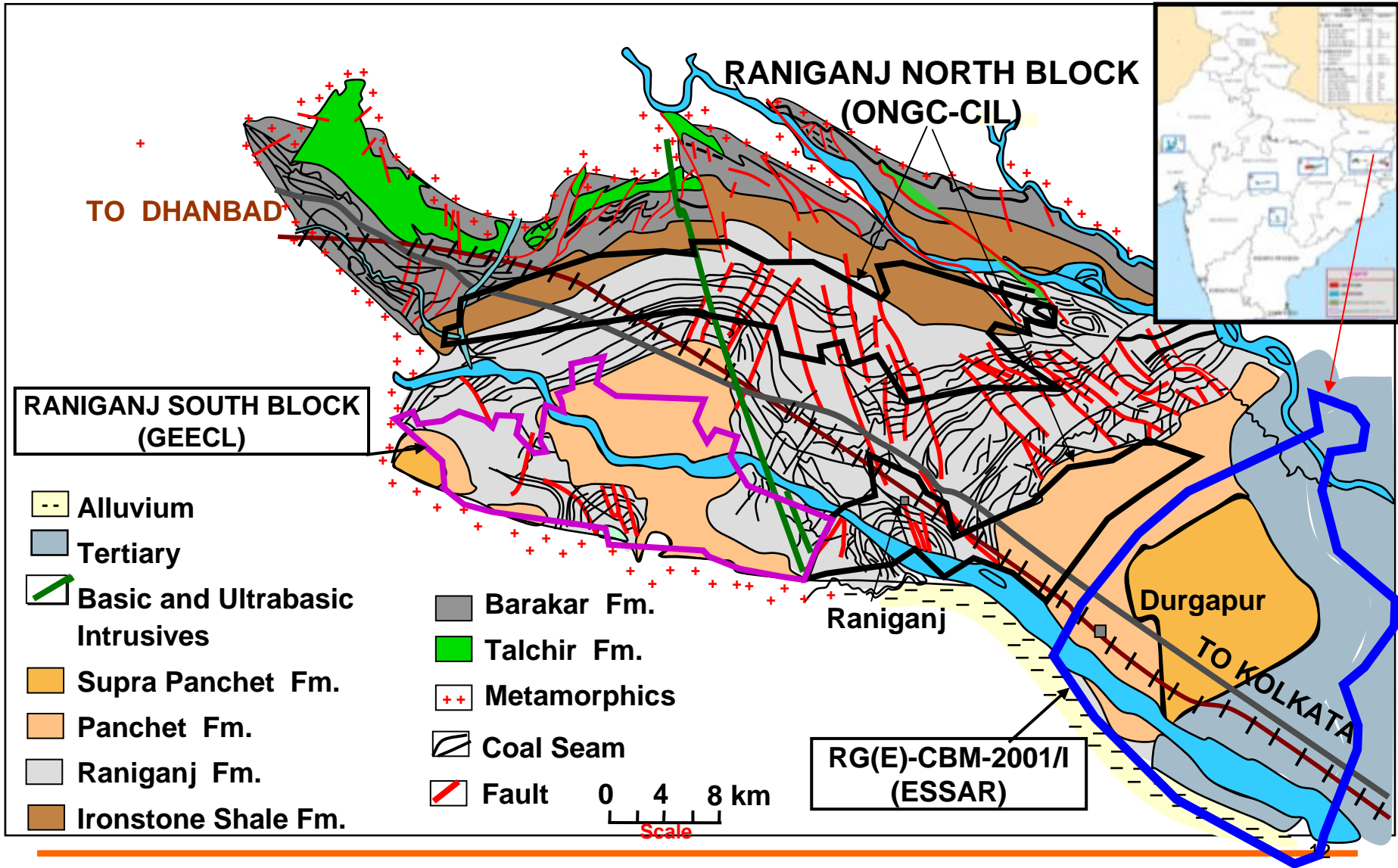
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# Raniganj CBM Block Progress Line



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# Geological Map – Raniganj Coalfield



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# PROJECT HIGHLIGHTS

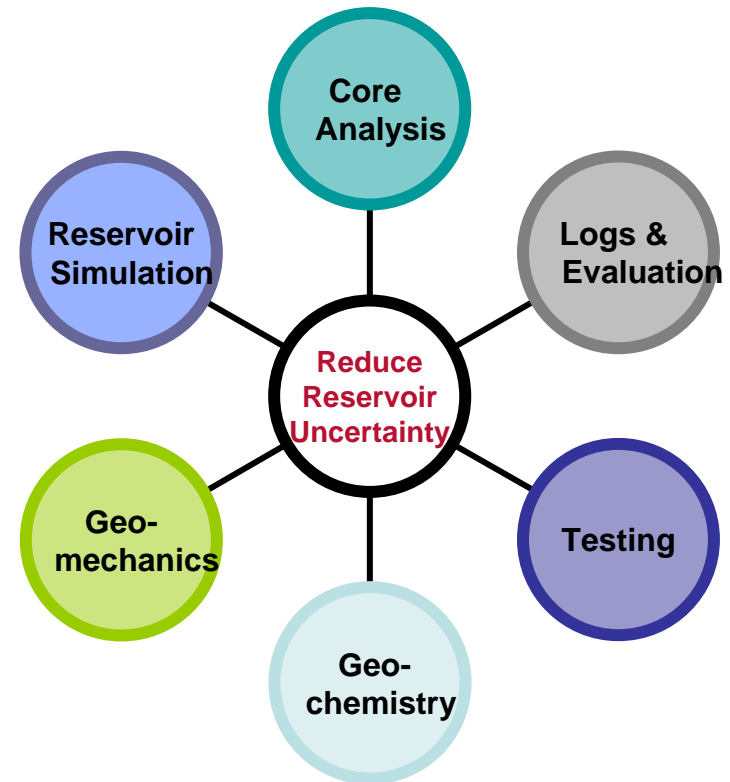
- ❖ Drilled 17 information wells & 15 CBM production test well which are currently on production .
- ❖ Important CBM parameters such as coal thickness, permeability and gas content essential for CBM production measured
  - Coal thickness > 30m completable.
  - Gas content > 6 m<sup>3</sup>/ton.
  - Permeability 5 to 10 mD.
- ❖ DGH approved 2.15 TCF CBM GIP in the fairway.  
NSAI, USA has certified CBM resource of 4.6 TCF for the entire block with recoverable resource of about 1 Tcf.



## Geosciences

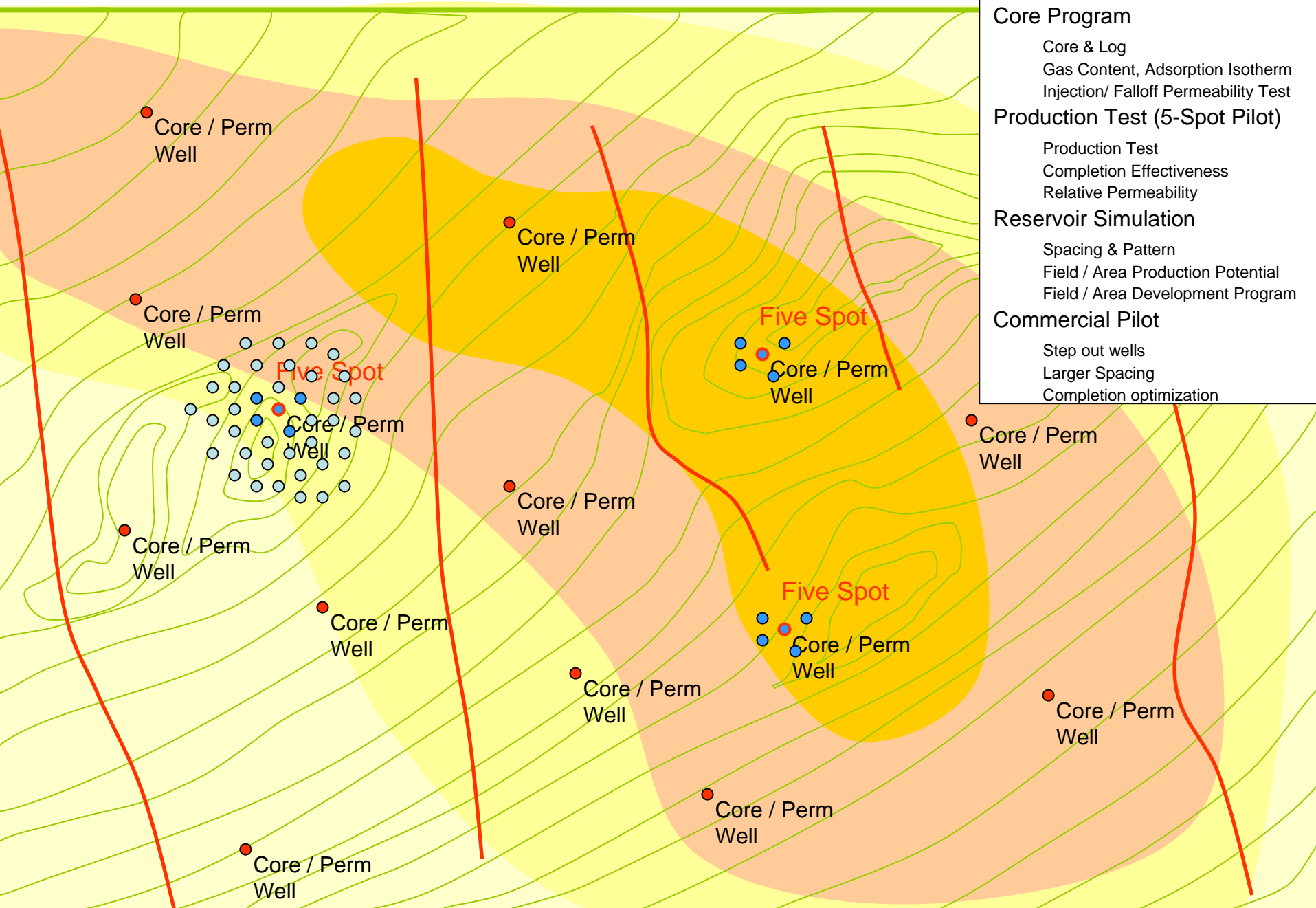
Operators need to know:

- Depth
- Thickness
- Quality / Rank
- Gas-in-place
- Permeability
- Reserves
- Critical Desorption Pressure
- Productivity



Integrating **datasets** with interpretive **expertise** to enable low risk **decisions**

# CBM Prospect Evaluation / Field Development



**Core Program**

- Core & Log
- Gas Content, Adsorption Isotherm
- Injection/ Falloff Permeability Test

**Production Test (5-Spot Pilot)**

- Production Test
- Completion Effectiveness
- Relative Permeability

**Reservoir Simulation**

- Spacing & Pattern
- Field / Area Production Potential
- Field / Area Development Program

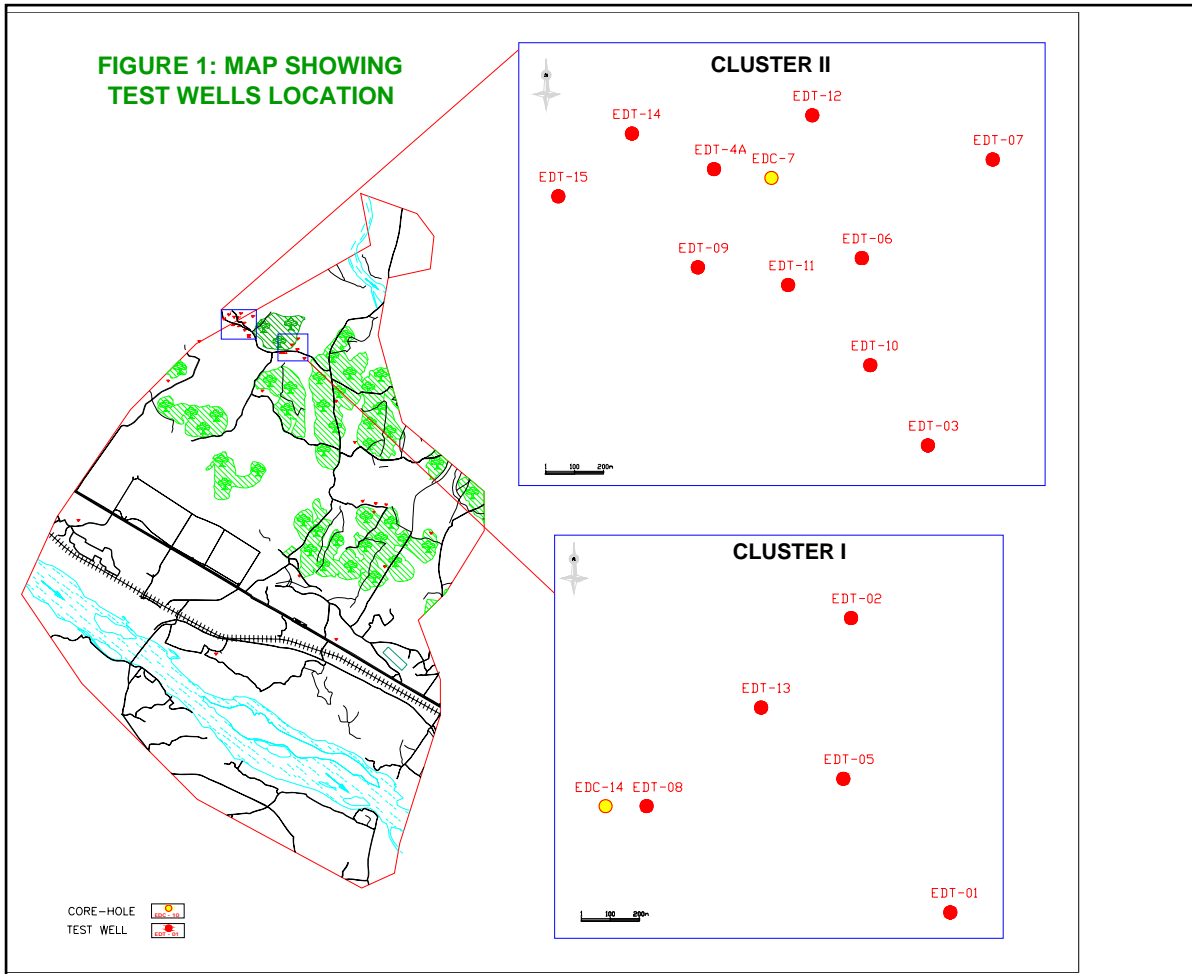
**Commercial Pilot**

- Step out wells
- Larger Spacing
- Completion optimization

# Early Development Approach

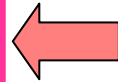
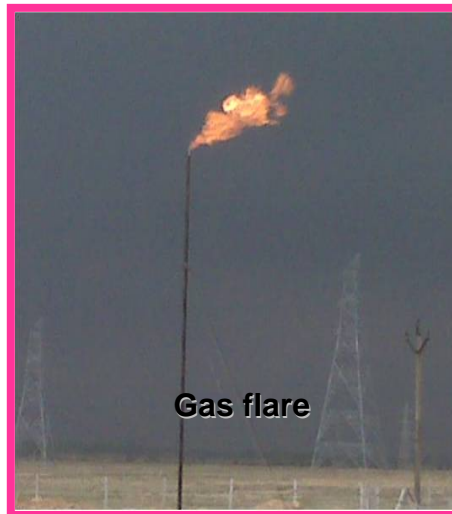
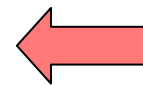
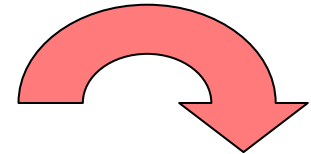
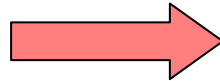
## Dual rig deployed & optimum well spacing

**FIGURE 1: MAP SHOWING TEST WELLS LOCATION**



- Cluster Approach for test well Drilling @60- 80 acre spacing during
- Exploration phase I resulted in early gas production
- The cluster test wells are currently producing gas at daily increasing rate
- Have indicated high potential For full scale development

# Pictorial progress...Raniganj



# DEWATERING OF TEST WELL

- CBM Test well currently under dewatering with a variable flow rate of 15-100 m<sup>3</sup>/day.
- PCPs installed *to achieve* optimum dewatering & CBM gas flow rates.
- Water from Raniganj field is of good quality.
- Elsewhere CBM Projects are not so lucky as water quality is not so good & requires treatment prior to disposal .
- Optimum pumping is required to avoid the damage to the coal seams & production of Coal fines.



Vegetation Grown through Pit Water



Plantation Around Drill Site

***CBM Field Development-  
Challenges***

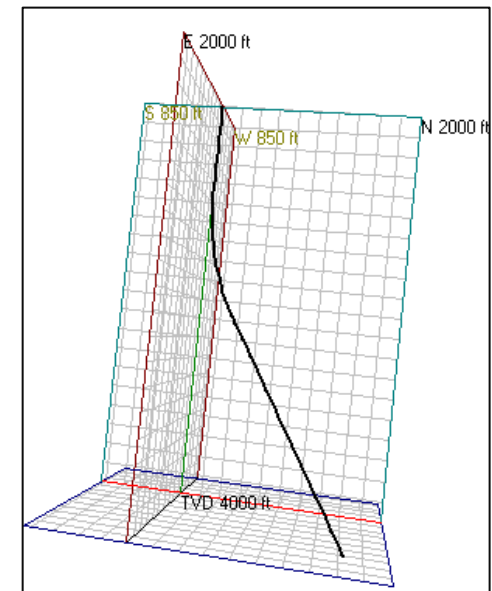
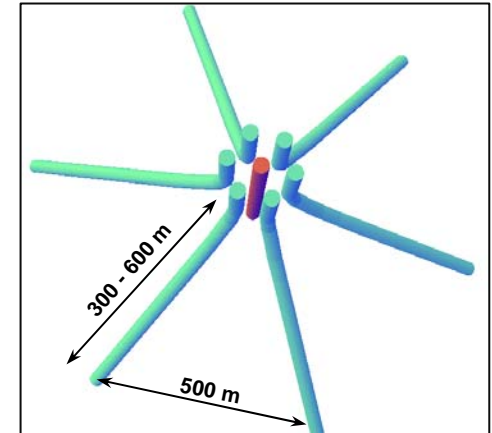
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# Strategy to reduce land footprints for CBM wells



Land Acquisition for drilling large number of vertical well is a challenge. A mix of vertical & inclined wells to reduce land foot-prints for wells

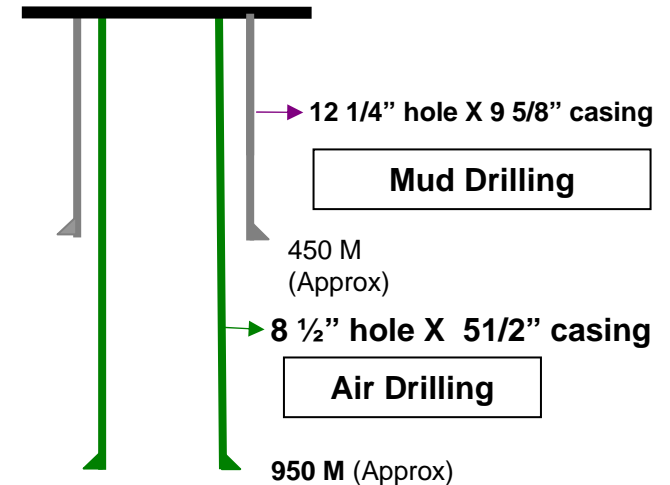
- One vertical well and six directional wells at 60 Deg phasing.
- Horizontal reach of the directional wells will be about 300 m to 600 m (i.e. 40 – 80 acres spacing).
- Drilling cost will increase marginally but shall provide following benefits
  - Land Requirement reduction up to 70%
  - Land cost savings and Civil work savings
  - Cost of inter location move of drilling rigs, logging trucks, cementing units, HF Units
  - Cost of pipeline, instrumentation and surface facility
  - Security
  - Logistics etc.



# CBM WELL DRILLING AT LOW COST-A CHALLENGE **ESSAR**

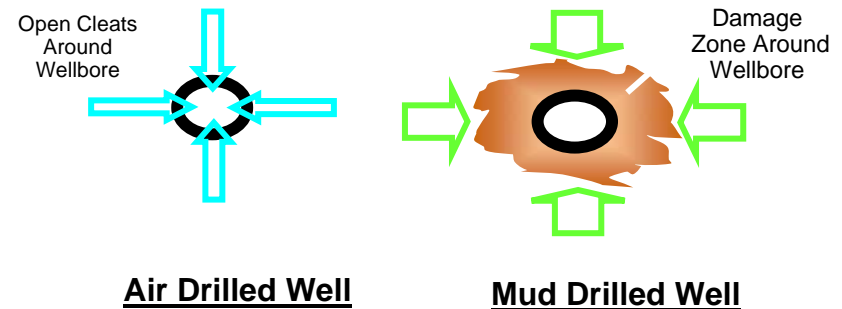
CBM Project Development requires drilling of large group of wells at a low cost is a challenge. An innovative combination drilling practice has been adopted by Essar

- Drilling up to surface casing by water -mud
- Air Drilling of coal section to the target depth

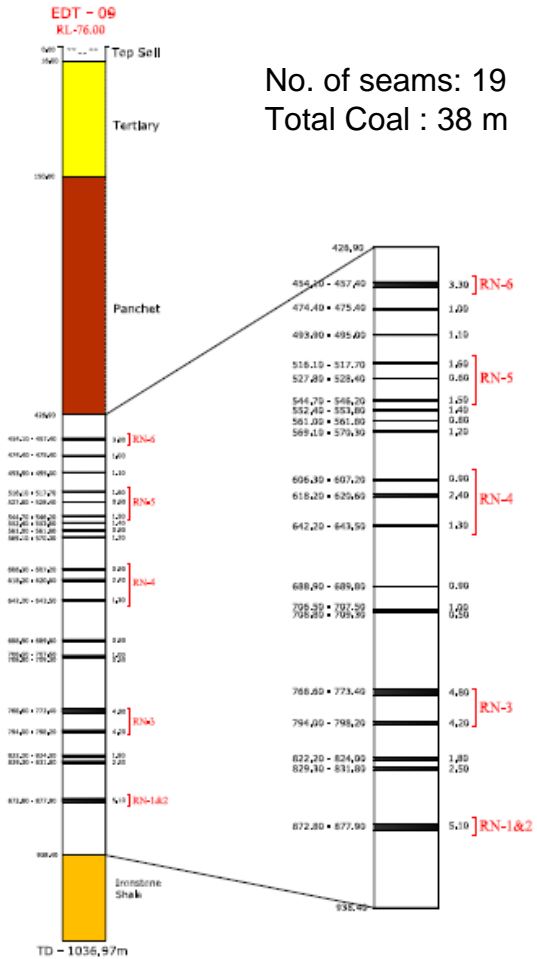


Air as drilling yielded benefits in terms of :

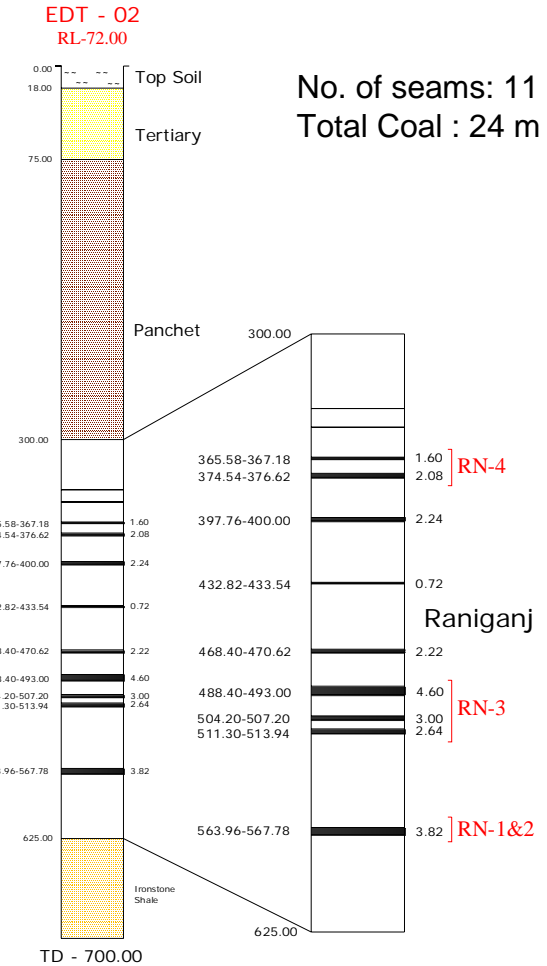
- Minimum formation damage
- Faster penetration rates, Longer bit life and fewer trips



# Multiple Seam Completion - a challenge



Cluster-II



Cluster-I

# Hydrofracturing

- Use of indigenous Proppant sand & chemicals. Design to place 4,000 lbs. proppant per foot of gross coal (70% 20-40 and 30% 16-30 Frac Sand)
- Completed 43 Hydrofrac jobs in 60 days for Phase I.3-4 Seams per well for 15 Test wells
- Indian record for most no. of frac jobs in least time (without use of coiled tubing).
- Logistic challenges & monsoon onset to be considered while planning campaign.
- 6 to 11 jobs per well planned for the current campaign. Going forward to 2-3 jobs per day envisage using CTU Technology.





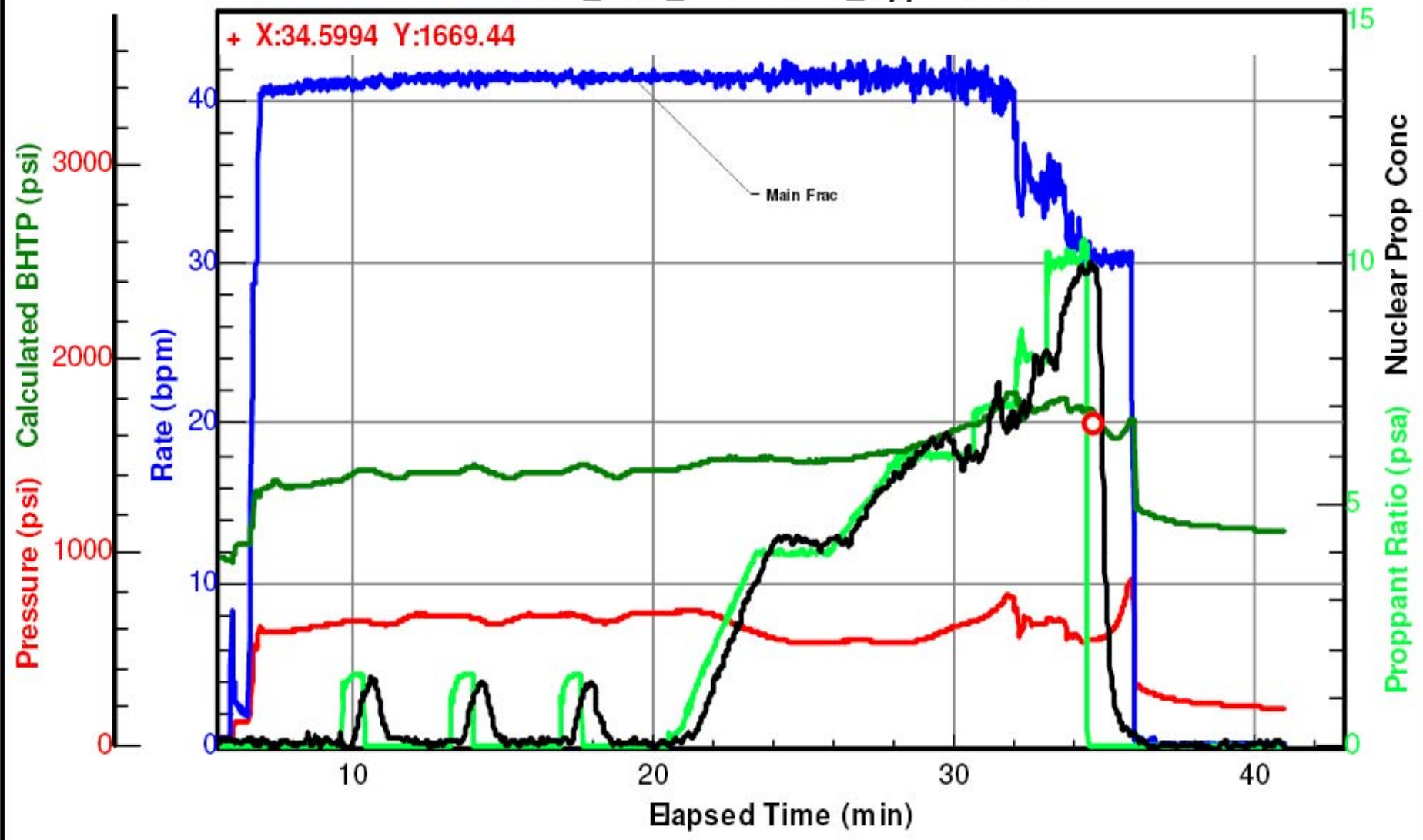
BJ Services JobMaster Program Version 3.20

Job Number: MainFracEDT15\_Upper

Customer: ESSAR

Well Name: EDT-15

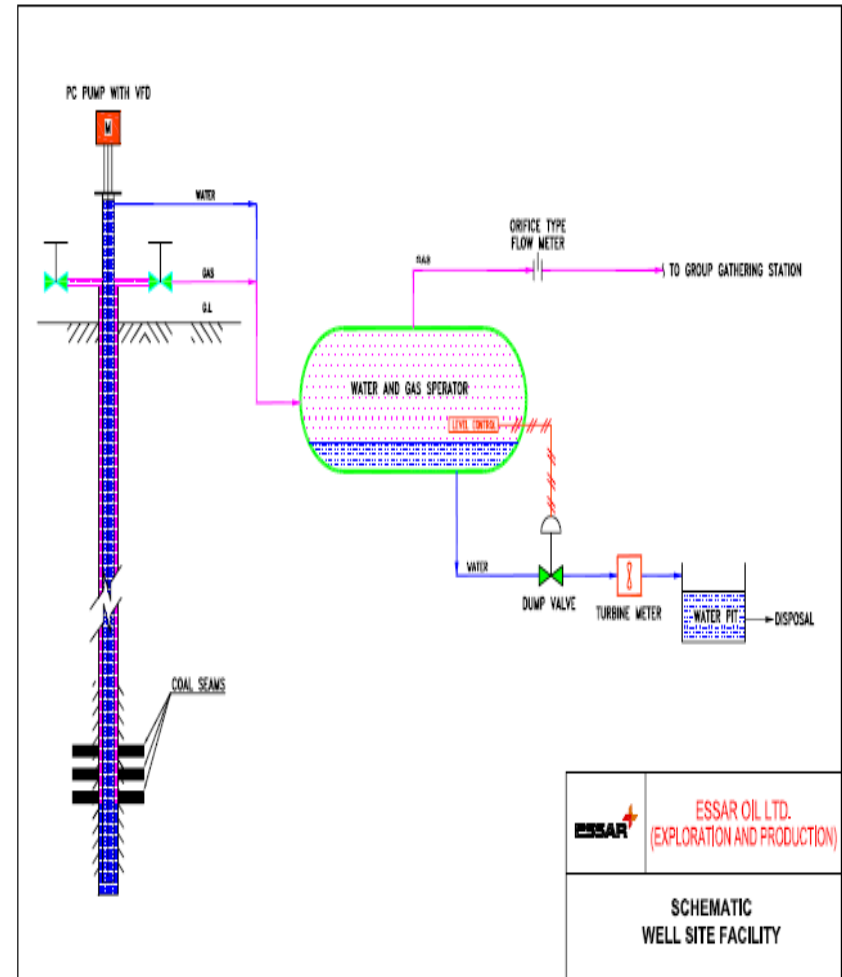
### Main\_Frac\_Job EDT-15\_Upper Seam



# DESIGNING PRODUCTION FACILITIES

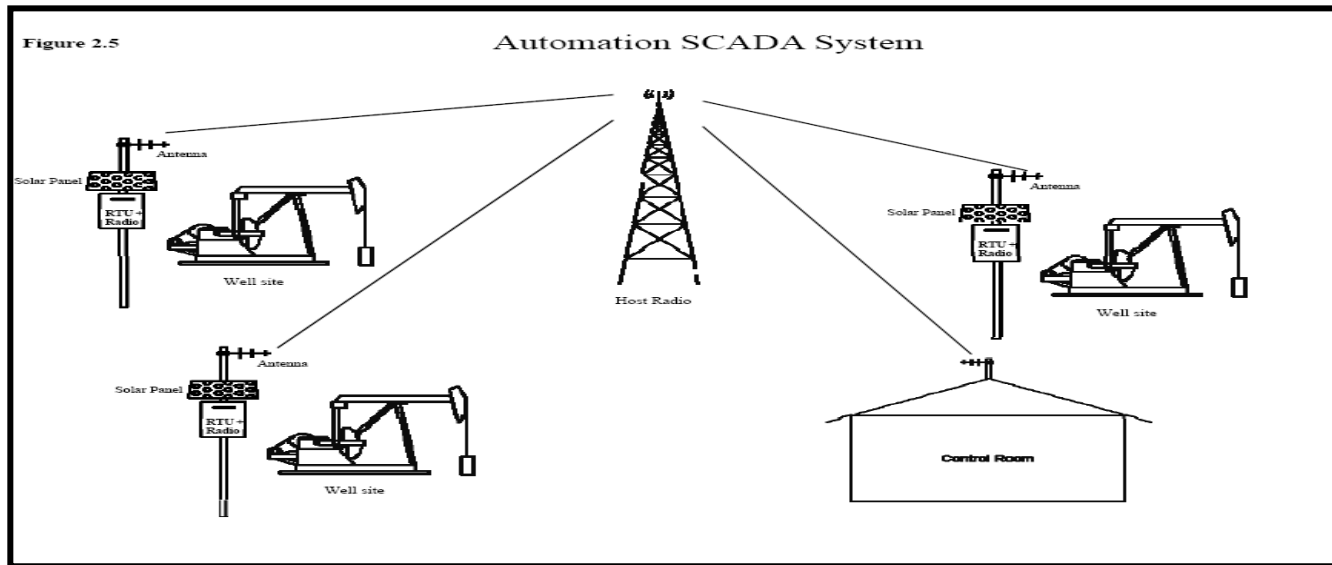
Once optimum well spacing & completion design have been selected production & operational facilities need to be designed. Individual well site setup will consist of the following:

- Prime Mover Source
- Electric Motor for running the down hole pump
- Variable Speed Drive for motor control
- Separators for Gas & Water
- Valves, pressure sensors/regulators & instrumentation
- Meters for gas and water measurement
- Safety relief valves and bypass gas line



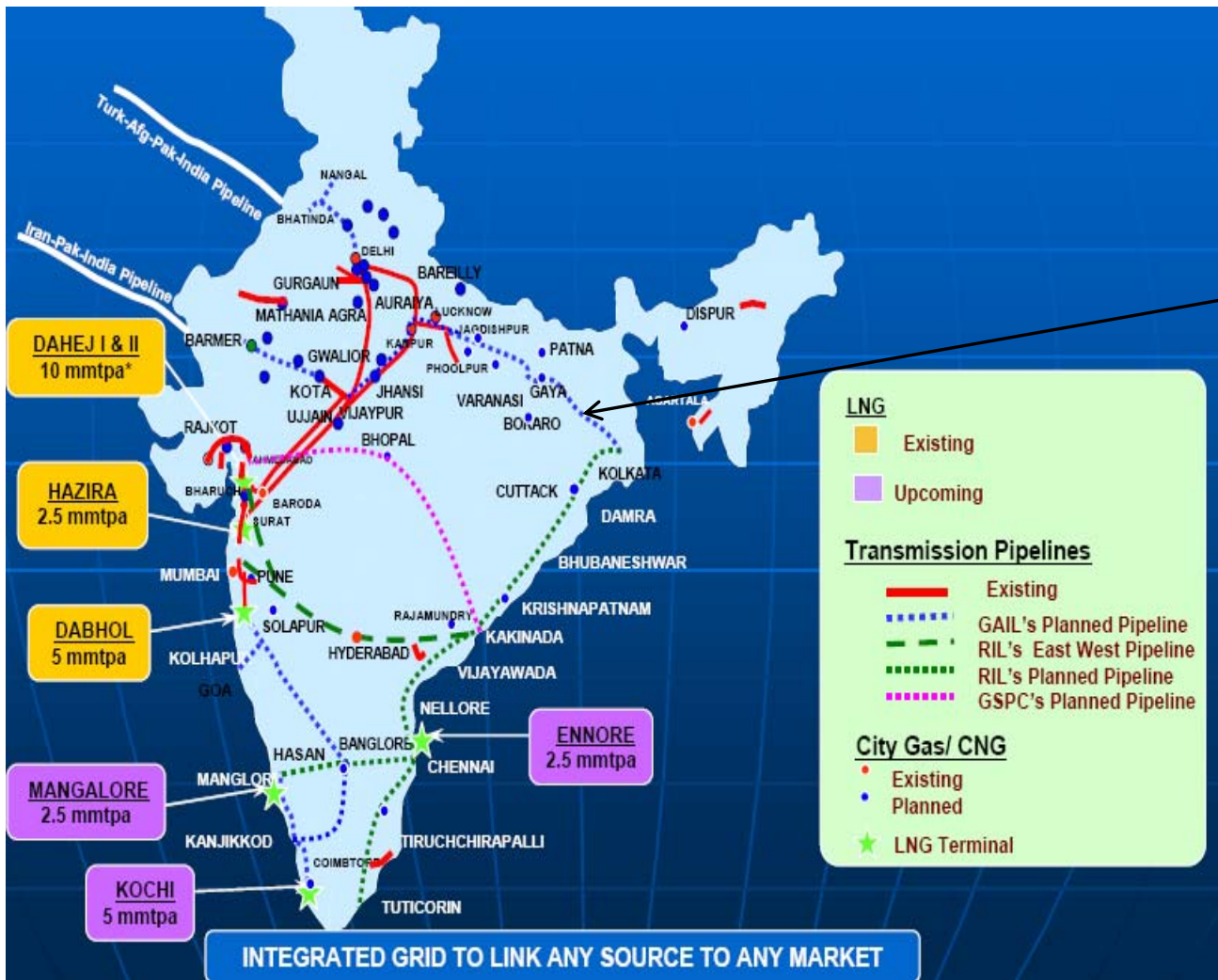
Schematic of Well site Facility

# Field Automation



- Depressurization of wellbore is required by dewatering of coal seams with help of compressor.
- GGS, Satellite and Main Compressor Stations, Metering System and Power Generation through SCADA.

# Gas Infrastructure in the Region



Opportunity to Connect with GAS Grid

- Project Economics Considerations**
- Gas Market
  - Pipeline infrastructure

- 
- **CBM field development requires a phased & structured evaluation programme right from fairway identification stage to full scale developmental stage for maximizing ROI.**
  - **Challenges to Indian CBM E&P are availability of current technology of low cost drilling , multiseam Hydrofrac , comprehensive reservoir description at every phase through reservoir simulation and production technology to achieve faster dewatering ,earlier & higher gas peak rate.**
  - **Reduction of land footprints by adopting a mix of vertical , inclined on in-seam drilling.**
  - **Development of gas infrastructure in the area such as Damodar Valley coal rich belt where there is presently no local supply of conventional hydrocarbon, CBM is to provide a viable source of energy.**

ESSAR 

*let's begin*

***Thankyou***

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# About the Speakers



## Mr. Prem Sawhmey, COO Clean Coal Business



Mr. Sawhmey has been actively involved in the CBM development efforts in India for past 15 years. He was the operations Manager for the drilling of the first ever CBM Wells by the ESSAR Group in India under the USAID's PACER programme, which provided good leads for the industry. He has specialized in project management, field implementation of drilling/production programs, contract negotiation and construction work. He is one amongst the first in sighting UCG and CTL opportunities in India. Currently, he is working with Essar Energy, as Chief Operating Officer – Clean Coal Business.

## Dr. Shailendra Kumar Singh, GM, CBM Head



He has rich experience of working in Oil & Gas and CBM exploration in India's state owned company Oil & Natural Gas Corporation for 22 years. Was involved in generating geological models for India's frontier, Bengal & Assam-Arakan Basins and in evaluation of CBM potential of all the major Gondwana basins. He had been associated with the pioneering CBM gas discovery in Jharia Block. Currently, he is working with Essar Energy, as General Manager – CBM Projects and is involved in planning & execution of Essar' CBM E & P programmes.

Disclaimer : Views expressed herein are of authors and not necessarily of the organization they represent