

GEF EO Terminal Evaluation Review Form

1. PROJECT DATA				
		Review date:		
GEF Project ID:	325		<u>at endorsement</u> (Million US\$)	<u>at completion</u> (Million US\$)
IA/EA Project ID:	744	GEF financing:	9.198	9.198
Project Name:	COALBED METHANE RECOVERY AND COMMERCIAL UTILIZATION	IA/EA own:	1.214	1.214
Country:		India	Government:	6.86 (2.32 – in kind)
		Other *:	1.76	2.99
		Total Co-financing	9.839	9.918
Operational Program:	OP 7: Reducing the Long-Term Costs of Low Greenhouse Gas Emitting Energy Technologies Focal Area: CC Mitigation	Total Project Cost:	18.92	19.11
IA	UNDP	<u>Dates</u>		
Partners involved:	Ministry of Coal (MOC) Ministry of Environment & Forests (MOEF) (CMPDI) Central Mine Planning and Design Institute Ltd (CIL) Coal India Limited	Effectiveness/ Prodoc Signature (i.e. date project began)		September, 1999
		Closing Date	Proposed:	Actual:
TER Prepared by: b. Wadhwa	TER peer reviewed by:	Duration between effectiveness date and original closing (in months): 60	Duration between effectiveness date and actual closing (in months): 110	Difference between original and actual closing (in months): 51
Author of TE: Dr MM SEAM National Consultant/Team Leader Dr RP VERMA National Consultant		TE completion date: July, 2009	TE submission date to GEF EO: August 2010	Difference between TE completion and submission date (in months): 13

* Other is referred to contributions mobilized for the project from other multilateral agencies, bilateral development cooperation agencies, NGOs, the private sector and beneficiaries.

2. SUMMARY OF PROJECT RATINGS AND KEY FINDINGS

Please refer to document GEF Office of Evaluation Guidelines for terminal evaluation reviews for further definitions of the ratings.

Performance Dimension	Last PIR	IA Terminal Evaluation	IA Evaluation Office evaluations or reviews	GEF EO
2.1a Project outcomes	S	S	S	MS
2.1b Sustainability of Outcomes	N/A	L	L	L
2.1c Monitoring and evaluation	N/A	S	HU	MS

2.1d Quality of implementation and Execution	S	S	S	S
2.1e Quality of the evaluation report	N/A	N/A	U	MS

2.2 Should the terminal evaluation report for this project be considered a good practice? Why?

No, while the TE report provides a comprehensive assessment of project performance, it does not present ratings for all of the required components, particularly key ones such as for sustainability and an overall project rating. The TE does, however, present how and what will be done to continue the work of the project.

2.3 Are there any evaluation findings that require follow-up, such as corruption, reallocation of GEF funds, mismanagement, etc.?

There TE states that some of the objectives would be met post project-completion and financed by GOI by 2011. This could make an interesting case for field verification of results expected being achieved.

3. Project objectives

3.1 Project Objectives

a. What were the Global Environmental Objectives of the project? Were there any changes during implementation?

The global environment objective being pursued is the reduction of GHG emission where the cost effective GHG reduction option of methane recovery is currently not undertaken primarily due to the lack of skill, training and access to relevant technology. The specific environmental objective of the project is to reduce CH₄ emissions by beginning the process of capturing methane from being released into the atmosphere at various stages of mining activities.

There were no changes to GEOs during implementation.

b. What were the Development Objectives of the project? Were there any changes during implementation? (Describe and insert tick in appropriate box below, if yes at what level was the change approved (GEFSEC, IA or EA)?)

The development objective is to promote the widespread adoption of methane recovery techniques in the underground mines that are reasonably gaseous and to use the clean fuel to augment the supply of energy resources, thereby reducing the chronic energy shortage faced by power plants, industries, households, and the transport sector.

This will be achieved by:

1. bringing to the country, through technology transfer, state-of-the-art resource assessment and recovery techniques under alternate mining conditions;
2. training a core group of mine planners, designers, engineers and geologists for designing, developing and operating methane capture projects on a sustainable basis;
3. strengthening the center for mine planning and design;
4. creating a mechanism to transfer information within India and from other coal producing countries of the world in the area of methane recovery and use at coal mines;
5. developing and adopting an action plan for replication of the successful aspects of the demonstration project; and
6. linking up with end users of methane and demonstrating a variety of methane utilization possibilities.

There were no changes to DOs during implementation.

Overall Environmental Objectives	Project Development Objectives	Project Components	Any other (specify)
n/a	n/a	n/a	n/a

c. If yes, tick applicable reasons for the change (in global environmental objectives and/or development objectives)

Original objectives not sufficiently articulated	Exogenous conditions changed, due to which a change in objectives was needed	Project was restructured because original objectives were over ambitious	Project was restructured because of lack of progress	Any other (specify)

4. GEF EVALUATION OFFICE ASSESSMENT OF OUTCOMES AND SUSTAINABILITY

4.1.1 Outcomes (Relevance can receive either a satisfactory rating or a unsatisfactory rating. For effectiveness and cost efficiency a six point scale 6= HS to 1 = HU will be used)

a. Relevance	Rating: S
<p>The project was quite relevant to the national context, national priorities and energy needs, as well as consistent with the GEF focal area/operational program. Methane being a very potent GHG, its emission control to atmosphere and utilization as fuel has a major relevance to climate change mitigation. Both national and international players have expressed interest in harnessing CBM and already 26 coal/lignite blocks in Indian coalfields has been allocated. Project is already influencing closer cooperation between Indian Public sector companies with ONGC and CIL joining hands in development of CBM in two blocks one each in Jharia and Raniganj Coalfields.</p>	
b. Effectiveness	Rating: S
<p>Overall, executing the project with the originally defined number of boreholes was not been practically feasible, due to the following reasons: (i) Many areas are heavily built up and with ownership titles not belonging to the mine, which sets a limit on the sites that could be developed; and, (2) Underestimation of the budget needed for drilling equipment, since only one vertical and one horizontal drilling systems were purchased instead of the original two per system, this has reduced the number of holes that can be drilled within the project period by half, and this 'period' was stretched from 2001-2004 to 2005-2007.</p> <p>Regardless of the delay and reduction of work program, the Evaluation states that these issues are not expected to impact the environmental and development objectives of the project.</p> <ul style="list-style-type: none"> • Component 1: Strengthen and increase the capacity of CMPDIL, BCCL, ISM, CMRI, Ministry of Coal, CIL, and the Ministry of Environment to develop and support mine associated CBM recovery and use projects, through training and experience in the identification, design, and implementation of programmes to recover and use coalbed methane in a safe, cost effective, and environmentally acceptable manner. <p>New technology to tap CBM services has been successfully introduced in the country and expertise built particularly in CIL, CIMFR and ISMU to enable Indian players to replicate the same in new areas.</p> <p>Capacity of the CIL subsidiaries CMPDI and BCCL was strengthened and the capability developed in recovery of CBM/CMM from working mine by procuring all modern equipment for drilling of vertical wells and its cementing after geophysical logging (hired services) of drilled well followed by perforation (hired services) to administer hydro-fracturing of potential coal seams by the project units in vertical CBM wells. All the procured international equipment was operated by departmental man power after pre-operation training and initial hands-on training.</p> <p>Graduate and post graduate courses started in ISMU on CBM technology with a view to train future manpower.</p> <p>Capability of CIMFR enhanced to carry out testing of core samples and assessing potential of new fields.</p> <p>Similarly DGMS also have exposure to the new technology in all its operation to enable to ensure proper safety regulations.</p> <ul style="list-style-type: none"> • Component 2: Prepare and execute demonstration projects and the Moonidih and Sudamdih coal mines located in the Jharia coalfield for the recovery and use of mine associated CBM in the Jharia coalfield. Design and execute CBM resource recovery programmes using three different drilling technologies at two proposed demonstration sites. <p>Given the large delays in project implementation, there was downsizing in the demonstration component as a result of the physical and technical constraints of the two selected project sites. Vertical wells were reduced from 17 to 7, only 1 GOB well drilled instead of the intended 10. There will be one underground drilling site at Moonidih and 2 sites at Sudamdih.</p>	

- Component 3: Use gas recovered from successful execution of the above objectives for vehicle refueling and electric power generation.

This objective was the easiest of the project objective as there was considerable expertise available in India and the equipment required was also available as such further strengthening of the gas utilization facilities should not have been a problem.

Considerable success has been achieved at Moonidih site with successful electricity generation since 27th June, 2008 which is supplied to mine worker colonies of Moonidih.

Gas from two wells is being harnessed for electricity generation and arrangement for power evacuation to more steady load of Water filtration plant is under way.

However at Sudamdih though horizontal drilling was started in June 2008 it could not be continued due to problems of the Steering tool. Now all the arrangement for gas compression for use by mine trucks are ready. The start of recovery of methane is awaited.

It is to be noted that all the gas utilization equipment has been purchased locally from Indian market and is working satisfactorily.

Slow pace of drilling of wells is seen as the main bottle-neck for the progress of the revised programme. The omission of the second units of vertical and horizontal drilling rigs and associate equipment from the original list has been a serious omission. It is high time that implementing agency considers acquisition of more drills to give necessary thrust to this extremely potential important energy resource process.

- Component 4: Develop and adopt action plan for replication of successful aspects of demonstration projects. Use the CBM Clearinghouse to disseminate information, educate, promote, and facilitate interaction with potential foreign investors.

An E-library has been made operational at CMPDI and a clearance house has also been established. To strengthen the latter a collaboration agreement has been signed with United States Environmental Protection Agency (USEPA) , which will provide necessary guidance/assistance to the officials of the clearing house for the period 2009-11.

One CBM website has also been created (www.cmmclearinghouse.cmpdi.co.in).

Additional courses on CBM have been added to ISMU curriculum as part of dissemination of knowledge on CBM.

c. Efficiency (cost-effectiveness)

Rating: HS

The biggest hurdle that the project faced was in the procurement of the equipment. The project had an overall delay of > 60 months from the start of the project to the start of first activity. The plethora of organizations involved in the project GEF, UNDP, UNIDO, GOI, MOC, CIL, CMPDI, BCCL, DGMS, CIMFR, ISMU, ONGC etc on the one side and the suppliers of equipment on the other side across continents needed a complex project set up which has to our great satisfaction survived all the vicissitudes.

Overall the operational relationships between the institution involved and others has remained cordial barring few exceptions with some equipment suppliers who played “snakes & daggers” with UNIDO. By and large technical capabilities associated with the project were well absorbed by the field staff in India and improved considerably with “on-job” experience.

4.2 Likelihood of sustainability. Using the following sustainability criteria, include an assessment of **risks** to sustainability of project outcomes and impacts based on the information presented in the TE. Use a four point scale (4= Likely (no or negligible risk); 3= Moderately Likely (low risk); 2= Moderately Unlikely (substantial risks) to 1= Unlikely (High risk)). The ratings should be given taking into account both the probability of a risk materializing and the anticipated magnitude of its effect on the continuance of project benefits.

a. Financial resources

Rating: L

The total budget for international equipment for CBM recovery provided at design was inadequate. There was a gross underestimation of the cost of the equipment, as a result, the project was downsized and an agreement was signed

<p>between ONGC and CMPDI & BCCL, in September 2002, to contribute USD 2.699 million additionally to part-fund two critical equipments. The remaining shortfall in funds of USD 1.097 million has been met by re-appropriation in the budgets, of which the Government of India will provide USD 1.049 million.</p> <p>Despite the fact that the project was a “demonstration project ” and hence entailed lot of expenses that would not normally form part of a commercial project (such as training, laboratory upgradation, etc), the cost of electricity generation at Rs 4.23/Kw-hr is quite competitive to the commercial energy rate existing in India. With a fully commercial project this generation cost is likely to come down substantially. It is obvious that CBM can sustain itself on its own. A quick estimate indicates that a CBM project can yield a high IRR of 25 – 40% indicating high profitability of exploiting CBM as a fuel source.</p>	
b. Socio-political	Rating: ML
<p>Besides environmental benefits and providing clean additional source of energy one of the major priorities of UNDP/GEF for the projects funded by them are the social benefits such as employment generation, poverty alleviation and other social benefits that is passed on to the people at local, regional and national level. The Moonidih CBM project is one of such projects where in funds have been provided by GEF/UNDP and it is for this reason the social impact of this project is elaborated below:</p> <p><input type="checkbox"/> It has to be borne in mind that Moonidih CBM project is still in the nascent stage and it will be rather premature to expect spectacular impacts at this stage. But the silver lining in the horizon is quite clear. When the project attains the desired goal it is bound to generate additional power and resultant additional employment opportunities & social benefits in not too distant future. Also CBM gas surplus to power generation can be marketed for domestic use locally as is being done by GEECL in Raniganj coalfield creating business and job opportunities at local level.</p> <p><input type="checkbox"/> If we look to what the project has achieved even at this stage there is enough to rejoice. It has brought valuable smile in hundreds of faces in Moonidih who now enjoy uninterrupted power supply and good voltage in their homes. In this connection some workers selected from hundreds of those who now get power supply from CBM project were interviewed by the consultants on 14.05.2009 at Moonidih project site.</p>	
c. Institutional framework and governance	Rating: L
<p>A decision was taken to continue the project as GOI S&T project for completion of the remaining objectives of CBM project. A management committee (Fig. 2) constituted of the following for supervision, direction and control of the project:</p> <p>i. Adviser (Projects), Ministry of Coal ii. CMD, CMPDI iii. CMD, BCCL iv. Director (Technical), CIL v. Officer In charge of CBM Project at CMPDIL to be nominated by CMD, CMPDIL.</p> <p>The Director (Tech/RD&T), CMPDI has subsequently been nominated by the Management Committee to act as Nodal Officer. The Committee thus constituted has been assigned the following responsibilities:</p> <p>i) The Committee shall develop yearly programme and review the status of projected activities on at-least quarterly basis and keep the Ministry informed. ii) Technical and commercial evaluation of the implementation of project and identification of areas requiring further attention. iii) Identification of location and replication of the technology for CBM extraction through departmental, JV or outsourcing mode in other areas of Coal India. iv) Suggesting of measures to be taken by the coal companies / government to improve extraction of CBM/CMM as an alternative source of energy from working mine area; v) To avail of services of expert as and when required for smooth implementation/continuation of the project. The expenses for availing the services of experts would be borne by BCCL as per the extant rules of the company; vi) To ensure proper manning of the project at all levels including drilling, extraction and distribution/utilization of CBM even at expanded scale.</p>	
d. Environmental	Rating: ML
<p>Moonidih is generating 500 KW of power since June 2008, consuming on an average 2000m3 per day i.e. saving 10000te of CO2 from going to atmosphere plus using 4500 m3 per day of CMM gas for power generation contributes to saving of 4292 tonnes of CO2 per year.</p> <p>Thus in one year operation about 14290te of CO2 per year has been saved. On increasing the power generation to 1 MW, this will double to about 28500te of CO2. Considering USD 20 per tonnes, CO2 saved, the project though currently not entitled for carbon credit under CDM (due its funding from grant by GEF/UNDP and GOI) but otherwise the project would have already earned USD 280,580 and would reach USD 561,060 per year when upgraded to 1 MW power generation capacity.</p>	

4.3 Assessment of processes and factors affecting attainment of project outcomes and sustainability.

a. Co-financing. To what extent was the reported cofinancing (or proposed cofinancing) essential to achievement of GEF objectives? Were components supported by cofinancing well integrated into the project? If there was a difference in the level of expected co-financing and actual co-financing, then what were the reasons for it? Did the extent of materialization of co-financing affect project's outcomes and/or sustainability? If it did, then in what ways and through what causal linkages?

Due to various reasons including perhaps the time the first cost estimate was made in 1997 to the time orders for equipment purchased were being executed in 2005, a long time lapse of 6 -7 years was there which could have contributed to the cost estimates being found way below the actual.

With International contribution being frozen, the only way for the project to go ahead was by increased financial commitments by GOI to the project. Co-financing which was about 43% by GOI went up to 49% on the first revision of the project cost to INR 92 Crores in 2004 -05 and has further been estimated to go up to INR 124 Crores by 2010 with GOI share rising to 63% of the total project cost.

b. Delays. If there were delays in project implementation and completion, then what were the reasons for it? Did the delay affect the project's outcomes and/or sustainability? If it did, then in what ways and through what causal linkages?

There was lack of detailed time schedule for the various activities – though overall life of the project was fixed for 5 years. The late kick starting of the project, the induction of UNIDO and the drawl of specification took extremely long time – possibly due to lack of fixing suitable milestone for monitoring over the progress of the project.

A project preparatory phase should have been allocated before start up of the project. Similarly with respect to delay in equipment procurement this evaluation team confirms the observation made by the mid term evaluation team that selection of UNIDO's as procurement agency was a correct one but what made actual procurement time taking was UNIDO'S tendering and contracting process and procedure were too rigid to handle purchase of this type equipment. Particularly its inability to re-validate the tender bids after the tender period expired (120 days), lack of suitable money deposit, and the precondition of allowing start of the tender and contracting process only after it had received money in its bank account did result in delays.

From the way the tender process moved to five rounds, it is obvious that more experienced was called for to handle procurement of specialized equipments needed. The non response by equipment suppliers further complicated the matter due to the fact of its being overwhelming sellers market. The evaluation team feels that such a situation would have occurred no matter who the procurement agency was. Off course it would be better that in future the UN System should not normally be involved in procurement of such specialized equipment.

c. Country Ownership. Assess the extent to which country ownership has affected project outcomes and sustainability? Describe the ways in which it affected outcomes and sustainability highlighting the causal links.

The country ownership has been very good and has positively affected the project outcomes and sustainability in spite of delays. There are many indication of country support for this project including the Ministry of Coal (MOC) which has under its administrative control the Coal India Limited (CIL), which has seven coal producing subsidiaries and the Central Mining Planning and Design Institute (CMPDI).

The (CMPDI), a subsidiary of the public sector company Coal India Ltd. (CIL) is the main implementing agency. CMPDI has formulated and coordinated the project from its inception. CMPDI works under the leadership and supervision of the Ministry of Coal.

Bharat Coking Coal Ltd (BCCL), a coal-producing CIL subsidiary, was the co-implementing agency. BCCL participated in the project formulation process as well and plays a major role in implementing field trials at the two specific mine sites at Moonidih and Sudamdih. In addition, the project partners relied on a variety of universities and technology institutes of repute to perform part of the study, research and engineering work, including the Indian School of Mines and the Central Mining Research Institute (CMRI), both based in Dhanbad.

Also, the Oil and Natural Gas Corporation (ONGC), a public sector company, was involved at a later stage by providing additional budget and support for equipment procurement and support when the drilling and gas recovery operations will start.

A National Steering Committee is set up under the chair of the Ministry of Coal, providing guidance and supervision on the project implementation. The Committee is convened by the Additional Secretary who is the Project Director, responsible for monitoring and adherence of the project's work plan The Committee has met four times so far; its last

meeting was in May 2004. The Project Director is assisted by the Project Advisor (CBM) to carry out coordination with various government ministries and agencies, provide guidance to the project team, to coordinate with UNDP and UNIDO, to review reports and to look after administrative arrangements required under the GoI, UNDP and UNIDO procedures.

Two other Committees provide a forum for programming, review and measures on operational issues:

- The Operational Executive Steering Committee, convened by the Chief Project Manager and consisting of representatives of the implementing agencies (CMPDI and BCCL) and the Directorate General of Mines Safety (DGMS) for reviewing the work progress on a regular basis,
- The Policy Advisory Committee is a forum to discuss broader policy issues and also to seek inputs from other organisations, besides the institutions involved in the project

All stakeholders did their best vis-à-vis numerous problems that arose in the implementation of the project. Despite constraint of GEF/UNDP it was commendable to see that GOI came up with additional funds and manpower to overcome the hurdles and thus sustain the project to bring to its laid out goals/objectives.

4.4 Assessment of the project's monitoring and evaluation system based on the information in the TE

a. M&E design at Entry	Rating (six point scale): HU
<p>The M&E plan in the ProDoc did not include a log-frame matrix, a project workplan or detailed budget that clearly outlines procedures for project monitoring. A log-frame with measurable indicators for each objective was introduced during the PIRs. The indicators specified in the log-frame however do not meet SMART criteria. Monitoring and Evaluation was to be undertaken through a tripartite committee – UNDP, GOI and UNIDO as well as a mid-term and final evaluation. Funding for M&E was not indicated in the budget. The indicators were not established at the design stage of the project. This is probably due to the absence of a results-based logical framework at the design stage. The language used for the indicators resemble more of an outcome than an indicator. In addition to the absence of a logical framework building on RBM principles, also noted is the absence of a performance monitoring framework with set performance measurements and targets.</p>	
b. M&E plan Implementation	Rating (six point scale): MS
<p>Though periodically monitoring committee met at the project level and at the national level, due to basic lacunae in the project report, there was continued period of fire fighting throughout the project period. Due to this, the project completion date had to be deferred from 2004 to 2007 and then to 2008 without achievement of even the tasks laid out by the revised curtailed scope of the report. Mid-term evaluation normally scheduled for 2002 was also deferred to 2004 due the poor progress of the project on the ground. The monitoring system proved Satisfactory as it did bring out the problems timely to the notice of project officials which allowed them to respond effectively to put the project back on the rail.</p>	

4.6 Assessment of Quality of Implementation and Execution

a. Overall Quality of Implementation and Execution (on a six point scale): S
<p>b. Overall Quality of Implementation – for IA (on a six point scale): S</p> <p><i>Briefly describe and assess performance on issues such as quality of the project design, focus on results, adequacy of supervision inputs and processes, quality of risk management, candor and realism in supervision reporting, and suitability of the chosen executing agencies for project execution.</i></p> <p>The biggest hurdle that the project faced was in the procurement of the equipment. The overall delay from the start of the project to the start of first activity of drilling has already been explained elsewhere. Once the equipment arrived at the site the implementation was quick and satisfactory.</p> <p>The plethora of organizations involved in the project GEF, UNDP, UNIDO, GOI, MOC, CIL, CMPDI, BCCL, DGMS, CIMFR, ISMU, ONGC etc on the one side and the suppliers of equipment on the other side across continents needed a complex project set up which has to our great satisfaction survived all the vicissitudes.</p> <p>Overall the operational relationships between the institution involved and others has remained cordial barring few exceptions with some equipment suppliers who played „snakes & daggers“ with UNIDO. By and large technical capabilities associated with the project were well absorbed by the field staff in India and improved considerably with “on-job” experience.</p>

As far as the financial planning is concerned it has already been stated due to various reasons including perhaps the time the first cost estimate was made in 1997 to the time orders for equipment purchased were being executed in 2005, a long time lapse of 6 -7 years was there which could have contributed to the cost estimates being found way below the actuals.

With International contribution being frozen, the only way for the project to go ahead was by increased financial commitments by GOI to the project. Co-financing which was about 43% by GOI went up to 49% on the first revision of the project cost to INR 92 Crores in 2004 -05 and has further been estimated to go up to INR 124 Crores by 2010 with GOI share rising to 63% of the total project cost. Of course the bulk of the increased cost is meant to meet the manpower cost but a significant part is toward acquisition of additional equipment. The above figures speak on their own on financial planning. It is to be emphasized the project get time overrun, the cost element is difficult to keep down.

Despite the fact that the project was a "demonstration project " and hence entailed lot of expenses that would not normally form part of a commercial project (such as training, laboratory upgradation, etc), the cost of electricity generation at Rs 4.23/Kw-hr is quite competitive to the commercial energy rate existing in India. With a fully commercial project this generation cost is likely to come down substantially. It is obvious that CBM can sustain itself on its own. A quick estimate indicates that a CBM project can yield a high IRR of 25 – 40% indicating high profitability of exploiting CBM as a fuel source.

c. Quality of Execution – for Executing Agencies¹ (rating on a 6 point scale) S

Briefly describe and assess performance on issues such as focus on results, adequacy of management inputs and processes, quality of risk management, and candor and realism in reporting by the executive agency.

The project has been a good example of local public co-ordination. There has been close collaboration between the local implementing agencies, the Indian Government and the UN agencies, especially given the budget and equipment challenges. All stakeholders tried their best in trying circumstances that this project faced. They all knew that the project was good for. Despite all the ups and downs none can deny that it has laid a solid foundation to enable the Indian coal industry to seize the opportunity of building up a CBM industry in the country. The biggest accolade goes to the International partners for coming forward to financially support the project and then to the local project personnel including GOI to make it a success. With the few remaining jobs to be completed there is no doubt the project will be a path breaking success.

5. PROGRESS TOWARDS IMPACT

a. What is the outlined outcomes-to-impact pathway?

Briefly describe the logical sequence of means-to-end linkages underlying a project (Outcome to impact pathways are the means-ends relationships between project outcomes and the intended impacts – i.e. the logical results chain of activity, output, outcome and impact)

Activities	Outputs	Outcomes	Impacts
Component 1: Strengthen and increase the capacity of CMPDIL, BCCL, ISM, CMRI, Ministry of Coal, CIL, and the Ministry of Environment to develop and support mine associated CBM recovery and use projects, through training and experience in the identification, design, and implementation of programmes to recover and use coalbed methane	Increased capacity, willingness and preparedness by GOI to utilize methane as a potential source of clean fuel. Drilling equipment procured for vertical wells and drill machine for in-seam long hole underground drilling. Geological information, mine data and projection data studied to select	CBM established as a subject in the Academic Institutions Increased national capacity to develop methane recovery from coal mines Commercial viability of CBM recovery demonstrated to the	GHG (specifically CH ₄) emissions reduced through process of capturing methane from being released into the atmosphere at various stages of mining activities. Increasing mine safety through methane drainage

¹ Executing Agencies for this section would mean those agencies that are executing the project in the field. For any given project this will exclude Executing Agencies that are implementing the project under expanded opportunities – for projects approved under the expanded opportunities procedure the respective executing agency will be treated as an implementing agency.

<p>in a safe, cost effective, and environmentally acceptable manner.</p> <p>Component 2: Prepare and execute demonstration projects and the Moonidih and Sudamdih coal mines located in the Jharia coalfield for the recovery and use of mine associated CBM in the Jharia coalfield. Design and execute CBM resource recovery programmes using three different drilling technologies at two proposed demonstration sites.</p> <p>Component 3: Use gas recovered from successful execution of the above objectives for vehicle refueling and electric power generation.</p> <p>Component 4: Develop and adopt action plan for replication of successful aspects of demonstration projects. Use the CBM Clearinghouse to disseminate information, educate, promote, and facilitate interaction with potential foreign investors.</p>	<p>Boreholes. Locations firming and commencement of drilling in a phased manner.</p> <p>Firming up of gas pipeline route, gathering and distribution.</p> <p>Drawing up of specifications under the guidance of Gas Plant Expert and equipment procured for recovered CMM utilization for power generation and use in mine vehicles.</p> <p>Data generated about CBM drilling along with the expenditure for gas recovery, its utilization for commercial viability or otherwise is shared with other stakeholders at large.</p>	<p>sector</p> <p>Substitution of cleaner burning methane gas for the low grade coal used currently as cooking fuel</p> <p>Mine workers experience decreased health/ environmental impacts (respiratory ailments, etc) of coal dust, high moisture and gassy mines</p>	<p>Better health/energy access for community of mine workers</p>
---	--	---	--

b. What are the actual (*intended or unintended*) impacts of the project?

Based on the assessment of outcomes [4.1.1] explain to what extent the project contributed to or detracted from the path to project impacts and to *impact drivers* (Impact drivers are the *significant factors* that, if present, are expected to contribute to the ultimate realization of project impacts and that are within the ability of the project to influence

The policy impact of the project has been very positive. Use of CBM recovery and utilization equipment for the first time at the country needed a lot of work to updating the safety regulation and equipment approval procedure. Constant interaction with DGMS at all stages, even training their executives abroad in USA has led to development of many new procedure and safety regulations which will make it easier for replication of CMM project. Involvement of CIMFR and ISMU to this is also to be noted.

All the players in the coal/gas sector of the country are positive in their approach to CBM/CMM development. CIL/MOC has appreciated the tremendous commercial potential over and above the mitigation of climate change in recovery and utilization of CMM from working mines. Secretary, MOC has already directed as a policy that CMPDI should prepare plans for identification of suitable blocks in CIL leasehold areas for recovery of CMM in commercial manner and replicate such projects which would be also entitled for carbon credits. With a coal production of 456 mt in 2008-09 CIL with 85% of coal production, should be the main focus

Around 193 coal blocks for captive coal mining have been allotted by MOC where considerable numbers of those are amenable to underground mining and these have a very profitable potential for recovery of CMM in advance of coal mining. These coal block owners have become aware of this additional potential and are seriously considering recovery

of CBM/CMM in advance of coal mining at the planning stage itself.

Vis-à-vis the expected situation at the end of the project, the main objective of the recovery of CBM and its commercial utilization at Moondih was fully achieved but at Sudamdih it could not be achieved despite best efforts and is likely to be achieved in 2009. Hence, the wider impact of the project on national level in terms of power is concerned, has yet to be achieved. Harnessing this additional energy source will obviously contribute to increased availability per capita of energy of the local population. It is well known that availability of commercial energy is important trigger to faster economic development and hence a better living standard.

Other objectives of the capability of planning, implementing and utilization have been fully achieved and are serving as the important impact driver so that India today can replicate such projects.

c. Drawing on the assessment of the likelihood of outcome sustainability [4.2], what are the apparent risks to achieved impacts being sustained and likely impacts being achieved?

Delays in equipment procurement which plagued the project in its early stages seem to have resolved themselves by time of project completion and do not present an apparent risk to achieved outcomes/impacts being sustained. Moreover, financing is also in place from GOI to complete the remaining aspects of the project.

The cost of electricity generation using CBM should remain competitive to the commercial energy rate existing in India, otherwise likelihood of not being able to commercialize such projects increases. For the moment CBM can sustain itself on its own with project data revealing IRRs in the range of 25-40%.

During discussions with ONGC officials at Bokaro it was gathered that they are facing considerable difficulty in acquiring land for each CBM well (1 hectare land required per CBM borehole). This is primarily due to inflated claims of compensation and job by several persons who did not even possess ownership title of plot.

Land title and relevant details of ownership and payment of compensation issues could pose risks to the project if not clearly articulated. These issues intensify in laying pipe lines and approach road construction where several plot of land may be involved.

d. Evidence of Impact

Question	Yes	No	UA
i. Did the evaluation report on <i>stress reduction</i> ² at the <u>local level</u> (i.e. at the demonstration-pilot level, etc)?	X		
ii. If yes, describe the evidence that was provided whenever possible quoting quantitative evidence. Also discuss the scope ³ of such reductions given the range of concerns targeted by the project			

Assuming the gas recovery system at Moonidih and Sudamdih (7 vertical wells, 1 GOB well and 3 underground long holes) will produce 32,000m³ of CH₄ per day, which is sufficient to generate 3.5 MW electricity this comes to about 11.5 MCM or 7626 tonnes of gas per year. This is equivalent to 160,151 tonnes of CO₂. The simple burning of methane (flaring) would reduce annual GHG emission to 155,525t of CO₂ equivalent assuming all CH₄ otherwise would have escaped to atmosphere.

Further if this gas is used as a fuel, this would lead further to annual CO₂ reduction of 180,000 tonnes of CO₂. Alternately Diesel would have to be used. Thus overall CO₂ reduction could touch 340,151 tonnes per year for the whole project as envisaged in by the revised project targets.

Currently Moonidih is generating 500 KW of power since June 2008, consuming on an average 2000m³ per day i.e. saving 10000te of CO₂ from going to atmosphere plus using 4500 m³ per day of CMM gas for power generation contributes to saving of 4292 tonnes of CO₂ per year.

Thus in last one year operation about 14290te of CO₂ per year has been saved. On increasing the power generation to 1 MW, this will double to about 28500te of CO₂. Considering USD 20 per tonnes, CO₂ saved, the project though currently not entitled for carbon credit under CDM (due its funding from grant by GEF/UNDP and GOI) but otherwise the project would have already earned USD280,580 and would reach USD 561,060 per year when upgraded to 1 MW

² Stress = Pressure on the environment caused by human activities; Reduction=decrease of this pressure

³ Scope refers to the broadness of results against original objectives.

power generation capacity.			
iii. Did the evaluation report stress reduction at the broader systemic level?	X		
iv. If yes, describe the evidence that was provided whenever possible quoting quantitative evidence. Also discuss the scope of such reductions given the range of concerns targeted by the project. See above. GHG emission reductions have impact both at local and systemic level.			
v. Did the evaluation report change in the <i>environmental status</i> at the local level (i.e. at the demonstration - pilot level, etc)	X		
vi. If yes, describe the evidence that was provided whenever possible quoting quantitative evidence. Also discuss the scope of change given the range of concerns targeted by the project.			
vii. Did the evaluation report change in the environmental status at the broader systemic level?		X	
viii. If yes, describe the evidence that was provided whenever possible quoting quantitative evidence. Also discuss the scope of such change given the range of concerns targeted by the project. The entire park area is now under a single, coherent management regime with a core protection zone (18,770 ha), a sustainable management buffer zone (79,590 ha) and a sustainable development zone (35,000 ha).			
ix. Did the evaluation report change in the socioeconomic status at the local level?	X		
x. If yes, describe the evidence that was provided whenever possible quoting quantitative evidence. Also discuss the scope of change given the range of concerns targeted by the project. Community of mine workers felt very positive about the CBM project light they were enjoying. They expressed their extreme happiness to get uninterrupted power supply and good voltage all the time. This light helped their family immensely in cooking, enjoying T.V/Radio programmes and other domestic work. Most importantly their children are able to give more time for their studies and home work. All the interviewed worker were thankful to the project for this facility (CBM power) and that all sang in unison that more such projects should come up and light up other homes else where also. The team was particularly amazed to know the awareness of the Beneficiaries about the environmental benefits of CBM power. It may also be incidentally mentioned that the CBM project at Moonidih was officially inaugurated by the Union Minister of State for Coal (Independent charge) on 26.06.2009 who has lauded the coming up of this project and availability of additional clean source of energy from the project.			
xi. Did the evaluation report change in the socio-economic status at the systemic level?		X	
xii. If yes, describe the evidence that was provided whenever possible quoting quantitative evidence. Also discuss the scope of change given the range of concerns targeted by the project.			
xiii. Did the evaluation provide evidence of any negative impacts (on drivers toward the projects intended impact, environmental status, socioeconomic status)? Describe the impacts that were documented and how severe were these impacts?		X	
e. Monitoring of impacts			
i. Are arrangements/institutions in place to monitor stress reduction/improvement in the environment and/or socio-economic conditions at the local level after project completion?	X		
ii. Are arrangements/institutions in place to monitor stress reduction/improvement in the environment and/or socio-economic conditions at the systemic level after project completion?		X	

6. LESSONS AND RECOMMENDATIONS

Assess the project lessons and recommendations as described in the TE

a. Briefly describe the key lessons, good practice or approaches mentioned in the terminal evaluation report that could have application for other GEF projects

The project has come at very appropriate time when world is clamoring for measures to check climate change. CH4 a powerful GHG, released due to mining into atmosphere, if captured and utilized would act as an energy source and reduce global warming and mining hazard in underground mines.

Successful completion of project at Moonidih has enhanced the national capability of CBM/CMM recovery technology and brought it at par with international practices. The data generated by the project has clearly established that CMM recovery from Indian coal basin is commercially possible in a viable and profitable manner.

Upgrading of lab facilities at CIMFR Dhanbad and skill of the scientific personnel at CIMFR and CMPDI has provided the mechanism for testing of coal cores in the country and predicting gas in place & reservoir in model for taking investment decision in large scale CBM/CMM recovery and utilization projects. Induction of CBM as a subject in ISMU will provide know how for geologists/engineers to explore and exploit CMM in advance of coal mining.

The constraint faced by the project has brought to the fore the pit falls to be avoided while formulating future projects. Provision for a detailed project report, detailed design, specification of equipment list of supplier, proper time schedule with major milestone cleared highlighted is a must. Mechanism for budget revision particularly over long gestation project, adoption of even-handed procurement procedure while remaining open and fair but requiring suitable penalty clause for non-serious suppliers.

A greater emphasis on in-house training of the personnel with assistance of equipment suppliers will be key factor in faster expansion of the technology in India.

The analysis of project delays in implementation shows that it would have been better to have a project preparatory phase of a year or so before starting the implementation of the project. This would have allowed proper project initiation, more detailed work on cost and time framework, training needs and possibilities, description of the project sites and to have detailed specifications of equipment needed with listing of potential equipment suppliers.

b. Briefly describe the recommendations given in the terminal evaluation

Using UNIDO for equipment procurement has shown to be inefficient and a major constraint. The procurement procedures of UNIDO were found to be quite rigid and at time inadequate. Suitable flexibility in the tendering process would have helped in price negotiation processes and equipment procurement.

Land ownership has been a significant issue for the drilling boreholes. The TE suggests that while drilling boreholes could continue, the technology of horizontal multi lateral boreholes should also simultaneously be perfected along with surface drilling of boreholes.

Using the services of an expert consultant in planning and management of projects in the Jharia coalfield as well as intimate knowledge of CBM would benefit the project.

CBM should continue in other blocks of the Damodar Valley coalfields and other coal fields in India with the objective of replication of this technology and generating power for coal mining operations by CIL.

The trainings should be provided to a broader set of employees, not just executives.

7. QUALITY OF THE TERMINAL EVALUATION REPORT

7.1 Comments on the summary of project ratings and terminal evaluation findings based on other information sources such as GEF EO field visits, other evaluations, etc.

Provide a number rating 1-6 to each criteria based on: Highly Satisfactory = 6, Satisfactory = 5, Moderately Satisfactory = 4, Moderately Unsatisfactory = 3, Unsatisfactory = 2, and Highly Unsatisfactory = 1. Please refer to document GEF Office of Evaluation Guidelines for terminal evaluations review for further definitions of the ratings. Please briefly explain each rating.

7.2 Quality of the terminal evaluation report	Ratings
a. To what extent does the report contain an assessment of relevant outcomes and impacts of the project and the achievement of the objectives?	MS
Overall, the TE was quite factual and informative, however, given the scale and scope of this type	

of project, more details could have provided a better learning opportunity for UNDP and GEF. The TE did present the achievements of the project and some very insightful observations and lessons learned, but it could have been more explicit on the recommendations for future projects. The TE did not provide rating for the majority of the evaluation criteria, especially given that the evaluation does not explicitly address the OECD DAC criteria, however for the rating provided there the TE does present complete evidence.	
b. To what extent the report is internally consistent, the evidence is complete/convincing and the IA ratings have been substantiated? Are there any major evidence gaps?	S
The report is internally consistent and complete; no evidence gaps were noted. Ratings are consistent with the PIR ratings.	
c. To what extent does the report properly assess project sustainability and /or a project exit strategy?	MS
The TE does not explicitly address the issue of sustainability, however, it does present how and what will be done to continue the work of the project.	
d. To what extent are the lessons learned supported by the evidence presented and are they comprehensive?	S
The lessons learned are well supported by the evidence presented on project implementation, with lessons drawn highlighting how this project could be more successful.	
e. Does the report include the actual project costs (total and per activity) and actual co-financing used?	S
Actual total costs and actual co-financing amounts presented.	
f. Assess the quality of the reports evaluation of project M&E systems?	MS
The evaluation of the M&E system did not cover M&E design but did discuss implementation to a small extent	

8. SOURCES OF INFORMATION FOR THE PRERATATION OF THE TERMINAL EVALUATION REVIEW REPORT EXCLUDING PIRs, TERMINAL EVALUATIONS, PAD.

No other sources were consulted.