



Workshop Proceedings and Recommendations

“Successful Introduction of High Capacity Longwall at Adriyala”

Organised by

The Singareni Collieries Company Limited

(A Government Company)

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Telangana (India)

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1. Objective of the Workshop

The commitment to Ministry of Coal to attain a production level of 1.5 BT of coal in India by the year 2019-20 while addressing environmental and social issues needs introduction of mass production technology for enhancing coal production from underground mines. In this context, the role of The Singareni Collieries Company Limited in introduction and more importantly sustaining underground mining technologies needs appreciation in general and in particular the recent performance of their Adriyala Longwall Project, which is India's largest underground coal mining project with a potential to produce 3 MTPA.

Workshop on Successful Introduction of High Capacity Longwall at Adriyala was organized to showcase the experience gained in Adriyala Longwall Project, which will pave way for introduction of such high end Longwall Technology elsewhere and help in overcoming the earlier impediments and boosting confidence in underground mining technology to facilitate more such technological achievements across the country in the coming years. High capital projects require robust project management skills and continuous risk mitigation strategies to accomplish the projects within the schedule and costs. Use of technology, remote and dynamic monitoring of health and performance of equipment plays vital role in reaping the benefits of using capital intensive technologies.

Bulk production from deep-seated underground coal mines is the need for economic mining. Adriyala project has carved a success story and this workshop was organized to share the learning and deliberate on future prospects. The event provided a platform to bring together eminent Professionals from Government, Industry, Manufacturers, Scientific Institutions and Universities to discuss and deliberate on key issues related to High Capacity Longwall Equipment for enhancing underground production.

2. Inaugural Session

Director (O), SCCL Mr. Ramesh Kumar spoke about the deeper deposits that need to be exploited for coal and hence, he underscored the need for underground mining.

CMD, SECL Mr. Ramachandra Reddy spoke about economic challenges being faced by the coal sector and hence, need to focus on economies of scale, indigenization of technology and capacity building within India. He also spoke of limiting procedural delays in contract management.

CMD, CMPDIL Mr. Shekhar Saran spoke of amalgamation of objectives such as coal conservation, safety, cost effectiveness and operational efficiency for selection of underground technology.

Advisor (Projects), Ministry of Coal, Mr. DN Prasad spoke about coal, the main stay of India's energy sector, and our dependence on it for next two to three decades to come and the need for proper development of the resource. He mentioned about importance of project formulation and estimation of costs and referred to Ananth Committee Report which highlighted the shortcomings in project formulation and need for flexible approval process, and prudent capability assessment for contract award. He observed that successful implementation of technology is critical in replicating the same in promoting underground coal mining in the country. Streamlining the equipment approvals by DGMS and selection of contractors with proven experience are some of the important areas in this direction. Adriyala being the flagship project of the country it is most important for proving the technology with the help of OEMs.

Principal Secretary, Government of Telangana, Mr. S Narsing Rao spoke about business models for development of projects and procurement of technology and equipment, and stressed the need for equitable risk and reward sharing. He also stated that risk-aversion of coal mining companies needs to be re-assessed.

Director General of Mines Safety, Mr. Rahul Guha spoke of leadership commitment, human resource training and ownership of initiatives as key differentiators. He also underlined the need for scientific basis for technology selection and advocated user-pull in place of supplier-push.

CMD CIL, Mr. Sutirtha Bhattacharya spoke of the need for business perspective of technology selection and project implementation. He stressed the need for consultative approach for cost estimations and flexible approval for cost revisions in complex projects where specifications evolve over time. He also advocated need for fiscal measures to be taken by Government of India to facilitate higher degree of investment in underground mining.

3. Technical Session – I

Paper by CSIRO Scientists Mr. Deepak P Adhikary and Mr. Rao Balusu focused on the preparatory works and studies conducted in Adriyala for assessment of various extraction technologies and designs. The paper included works such as numerical simulation and high capacity longwall simulation.

Paper by Mr. B. Ramesh Kumar, Director (O), Mr. S. Chandrasekhar, GM (ALP) and Mr. B. Veera Reddy, Project Officer (Adriyala) focused on the strategic significance of development of mass production technology for deep seated deposits, and presented the construction stage works such as punch entries, shaft sinking, power supply infrastructure, ventilation system and air chilling plant.

Mr. Andrew Rutherford stated in his paper that capacity-wise Adiyala is comparable to high capacity projects in Australia and focused on success factors and challenges for longwall technology in India. He called the project as the watershed project.

4. Technical Session – II

Dr. Russel Frith presented the geotechnical uniqueness of the Adriyala project which impacted the roadway development rate and strata support systems for installation and longwall retreat. He underlined that there was no delay in the project due to strata control issues. He believes that the strata control systems, given the geotechnical constraints at Adriyala, are state of the art in the world.

Paper by Mr. Brett Moule of Caterpillar focused on their equipment selection process for longwall, tenets being productivity and safety. He talked about capacity alignments for shearers, AFC and roof supports and also advocated partnerships between project developers and equipment suppliers for success of a project.

In their paper, Prof. DC Panigarhi, Mr. CV Reddy and Mr. G Venkateswarlu, presented the findings of ventilation planning and optimization studies, ventilation network modeling using VENTSYS software, and air cooling system planning using chillers, and their impact on system design and implementation.

5. Technical Session – III

Paper by Mr. Paul Davis focused on electrical equipment and installation in challenging conditions such as high humidity and high pumping requirements. On a similar theme, the paper by Mr. Anand Agarwal, Mr. G Narasimha Rao and Mr. AV Raghuram considered safety features of electrical installations in Adriyala project.

Paper by CODCO team of Mr. Diao Jianhua, Mr. Dai Qiuliang, Mr. Qin Yijun and Mr. Yue Yanbo talked the trunk belt conveyor used in Adriyala, its design concept, calculation theory and key technology. Paper described the application of multi-drive unit, variable frequency drive (VFD), torques limiting backstops and automatic control system in trunk belt conveyors.

In the paper by GMMCO, Mr. Suresh Kumar presented the philosophy of maintenance support and spares management for Adriyala project. He underlined the need for trained human resources for successful operations of the project.

6. Technical Session – IV

Paper by CSIR-CIMFR team of Mr. G. Banerjee, Mr. KP Yadava, Mr. D Kumbhakar & Ms. Paromita Ganguly talked of parting plane approach developed by CSIR-CIMFR for identification of caving layers, roof categorization, support requirement and prediction of main and periodic falls overlying a coal seam to be extracted by longwall method.

Paper by Mr. John Loui Porathur, Mr. B Veera Reddy, Mr. Katta Sridhar, Ms. Chandrani Verma, Mr. S Chandrashekhar & Mr. SVSS Ramalingeswarudu presented the findings of subsidence prediction studies carried out with newly developed inclined seam subsidence engineering principles using asymmetric influence zone method. The predictive analysis will have significant impact on safety management of Adriyala longwall.

In the paper by Mr. RVK Singh, risks of spontaneous heating in longwall projects due to broken coal left behind the chocks and ingress of oxygen in the goaf and described measures taken at Adriyala to prevent and control spontaneous heating by inertising goaf is dealt.

7. Conclusions

Coal is and shall remain the mainstay of Indian energy sector with the Government of India's stated objectives of Electricity for All.

Economics of coal mining, as also power generation from coal, has had significant impact on preference given to surface mining in India, resulting in nearly 92% of Indian coal produced through surface mining methods.

Underground mining in India has perennially suffered with low production capacities, productivity and efficiency. Costs have been high and capital budgets unpredictable due to delays.

Underground mining needs to have strategic re-focus in the Indian context with challenges of growing demand, constraints of availability of land, environmental concerns and increasingly deeper deposits.

Project readiness assessment, execution planning, risk identification and mitigation measures, project design and engineering, procurement and contract management systems need to improve to be aligned with best practices in the world.

Longwall technology is adaptable to conditions as unique as those of Adriyala - deep seated, moderate gradient, weak roof (CMRR), with strata control issues. Adaptation is the key.

Implementation at Adriyala showcases that high capacity longwall option needs careful consideration in India and notion of failure associated with this technology in India on account of geo-mining conditions needs re-assessment.

Safety has to be a key decision parameter from project conceptualization stage to its final implementation and operation.

Project development and construction needs to gear up for technology adoption from the start; and scope of modifications and re-working of development and infrastructure facilities should be limited.

Predictive strata control systems enhance safety and productivity. Data generated in operations must fed back into the system to increase the degree of predictability.

Environment at working faces impact equipment, power installations and human resource efficiencies. The ratings and specifications must be aligned to the expected mine environment.

Training of human resources, close cooperation with maintenance contractor and effective management of spares/stores (including Vendor Operated and Managed Stores) are keys to operational efficiency and economics of extraction.

Leadership commitment and persistence are key to successful project implementation.

8. Recommendations

Project conceptualization, investigation studies and execution needs to have a dedicated Project Team with multi-disciplinary skill sets and there needs to be a cultural shift from crisis management to that of preparation and planning.

- a) For high end technology projects, a Committee comprising multi-disciplinary team should be constituted by the project proponent at the start of the project and they should have powers to sanction investigation studies.
- b) The Committee should be formed at corporate level with active participation from departments of finance, materials management, contract management, law and taxation, apart from engineering disciplines of geology, mine planning, engineering and others.
- c) Project planning must incorporate risk management matrices including probabilities of a risk event, impacts of such risks, responsibility and accountability for those events, risk mitigation measures, and mechanism for review and modification in risk matrices.

Preparatory works – geotechnical studies, subsidence studies, ventilation planning and others – have high impact on technology and equipment selection.

- a) The technology and equipment selection must be well documented from business and technical perspectives.
- b) Global benchmarks for geo-technical and investigation studies must be established and modifications for suitability to Indian context must be established.
- c) Proving the technology is highly critical for which OEM have to partner with project proponents for guiding and implementing the project.
- d) Spare / Parts of OEM quality to be available indigenously or encourage OEM to set up manufacturing works as a part of "Make in India Policy"
- e) Training and Skill Developments for better absorption and execution of High capacity longwalls in all aspects
- f) Statutory approvals by DGMS also need review to avoid delays in extending the same. Adopting the test certificates of similar safety regulators outside the country should be honoured by DGMS.
- g) It should be the endeavor of the project proponent to conduct geotechnical and investigation studies exhaustively prior to technology selection
- h) Assumptions in technology and equipment selection must be limited and any waiver for studies must be justified and documented.

Project Cost Estimations and Revisions and their approval process must be flexible and be based on scientific studies, which must recognize complexities and evolving nature of project specifications.

- a) Project cost estimations must be based on sound foundations of technology and equipment selection.
- b) For cost estimations, the project proponent should adopt a consultative approach through market studies, meetings with prospective vendors and/or engaging external consultants with prior experiences of similar work.
- c) The Coal companies should review the mechanisms of project cost approvals and revisions and create a separate channel for complex projects where financial estimates are evolving, clearly defining the nature of projects, responsibility and accountability matrices, flexibilities in revision process, documentation and review of escalation points, and frequency of revisions.

Partnership approach to mine engineering, design and equipment procurement and operations and maintenance are key success factors. Collaboration leads to better implementation. For procurement of equipment, from tender specification stage itself, compatibility of various packages including their communication systems, needs to be well established.

- a) The procurement procedures for goods and services of the coal companies must be reviewed for creating a special channel for complex and high end technology projects.
- b) The nature of new mechanism should be that of collaboration and alliances for partnership in development of complex and high end technology projects.
- c) Studies should be conducted to establish the policies and procedures adopted by global companies for such partnerships and collaborations.
- d) Standardization of documents should be targeted but there must still be scope for flexibility in special cases.

The Government of India should consider provision of fiscal incentives for greater investments in underground mining.

- a) Fiscal incentives for import of technology and equipment for high end technology projects such as longwall mining.
- b) Accelerated depreciation benefits for income tax purposes on the capital invested in such high end and complex projects.