

# Technological Innovation

The Company is focused on enhancing its core competitive advantage and economic efficiency, further stepped up its efforts on the integration of technological resources, improved the technological innovation system, reinforced the exploitation and application of key technologies to support the development of its core businesses, all of which boosted the enterprise's internal drive for growth in 2006.

## I. New Progress on the Construction of the Innovation System

The Company has established a technological innovation and management system comprising Technology Development Department and Science & Technology Management Departments of subsidiaries, state level and provincial level technical centers, and post doctoral scientific research workstations. Presently, the Company owns two state level technical centers, two provincial level technical centers, and two post doctoral scientific research workstations.

The Company has been proactive in developing open and stable cooperation relationship with academic institutions and scientific research institutes and has formed a combined mechanism of industry, education, and research based on the Company's extensive involvement with academic institutions and scientific institutes, sharing benefits and risks through commissioned development, joint exploitation, transfer of achievements, and co-establishment of organizations for technical development, as well as in other various forms. Our subsidiaries have founded long-term strategic collaborative relationship with China University of Mining & Technology, University of Science and Technology Beijing, Shandong University of Science and Technology, China Coal Research Institute, Dalian Institute of Chemical Physics, Central Mining Institute of Poland, and other institutions, which have provided strong technical support for the implementation of key technological innovation projects and has improved the enterprise's capacity for independent innovation.

## II. New Achievements in Technological Research and Development

Our Company has focused on production safety, building operational systems and development of core businesses, expanded technological exploitation and application of advanced technological achievements, which resulted in a number of significant technological achievements, and formed the basis of the Company's unique core technology. In 2006, the Company won 12 provincial level and ministry level awards for technological advancement as well as 15 awards for technological advancement granted by China National Coal Group Corp. The Company has been actively developing intellectual property rights and protection of proprietary techniques, having filed application for 45 patents (of which one is an invention patent), and 9 of them have been granted. The Company also placed much emphasis on the introduction, digestion, assimilation, as well as re-innovation of international advanced techniques, to master the patented technique for manufacturing super-strong mining chains and has gained the cost advantage in product manufacturing and benefitted from the radiating effect of international brand names, through the acquisition of Parsons of the United Kingdom, a member of the FKI Engineering Group. At the same time, the Company has also been proactive in promoting and applying new techniques, methods, and processes to enhance the enterprise's core competitive edge.

Important technical projects accomplished by our Company include:

### (1) Technical research on the construction of a combination of open-pit and underground mining for Pingshuo Mining Area

By implementing the above project, a series of technical difficulties ranging from roof-fall control, top-coal crushing and low recovery rate issue have been overcome in China's fully-mechanized top-caving mining when encountering shallow-buried mining face, hard roof as well as thick and hard coal seam. A complete set of technology for a combination of open-pit and underground mining which is not only safe but also of high efficiency has been formed, providing technical support for the similar conditions in the northern Shanxi region of China. The above technology has resolved the problem of recovering 250 million tons of coal resources in the non-mining sections of the open pit mines. It also resulted in the recovery rate of underground working panel being above 85% and recovery rate of





mining sections above 75%. The above technology also results in a decrease of 19 million cubic metres overburden from open pit mines, a reduction of 70 million cubic metres of dumping surface soil and a reduction in the area of land purchased by 1.3 square kilometres, thus achieving rational and coordinated coal mining, reduction of sulphur content and improving the quality of commercial coal which has further helped reduce discharge of contaminants at the source and enhanced our market competitive advantage. This project was honored with a 1st class award for technological advancement in the coal industry in 2006.

#### (2) Development and Application of High-efficiency Mine Fire-proof and Dust Suppression of New Materials

Multi-effect dust suppression and flame-retarding powder of fly ash composite colloform fire-proof and fire-extinguishing new materials, as well as a multi-purpose grouting detection control system with automatic detection of grouting parameters, remote control, and other functions were developed in this project through independent research, in which fly ash was effectively utilized. The functions of control over spontaneous combustion of coal seam and dust suppression were fully brought into play, and the harms generated by mine dusts were efficiently controlled, which was significant in ensuring safety in mining production and over the protection of physical and mental health of miners. This technological achievement has reached international advanced level and the project was honored with a 2nd class award for technological advancement of 2006 for state safety production.

#### (3) Research and Application of the Technique for the Recycle of Waste Water in Mining

8.4 million tons of mine waste water was recycled per annum through this project, which reduced the usage of underground water, conserved water resources, and saved an annual expenditure amounting to RMB5.0 million, bringing social and environmental benefits. This project was awarded a 1st class award by China National Coal Association in 2003 and a 2nd class award for technological advancement by China Coal Group in 2006.

#### (4) Research and Development of Armored Face Conveyors

Newly developed products have expanded to about 500 specifications in 82 series of 10 major types, with a full range of varieties and specifications. Our core technology is at the forefront in the domestic industry, in particular SGZ1000/3 x 700KW which is a complete set of curved armored face conveyors. It is the first equipment and the first complete set of its kind and has filled a market vacuum of such products produced in the country and satisfied the requirements of different mines and is able to replace the import of such products. Complete sets of heavy-duty equipments have also been exported to Russia, India, Turkey, Bangladesh, Vietnam, and other countries.

#### (5) Development and Application for Integrated Utilization of coal slurry and gangue

By utilizing this research achievement, the water content of slurry was reduced to a level below the fixed parameter, and then, coal middlings and slurry were blended together in certain proportion for power generation that saved about 140,000 tons of raw coal annually. At the same time, the processed gangue and the coal middlings were prepared into fuel to be used for combustion of circulating fluidized bed boilers (CFB), with an annual consumption of 300,000 tons of gangue and 300,000 tons of coal middlings, which replaced around 200,000 tons of raw coal.

#### (6) Integrated Safety Monitoring Technique for Mine Shaft and Shaft Wall

This technique has been successfully used for an organically integrated monitoring of shaft wall strain, surface deformation and aquifer level changes to forecast the potential mining shaft-lining ruptures, and to scientifically guide and control the shaft wall engineering through the realization of automatic monitoring, which has greatly enhanced the security level of coal mines. This technique has reached the international advanced level and the project was awarded with a 3rd class award for technological advancement in the coal industry in 2006.

#### (7) Application of Centralized Monitoring System for Mine Hoist and Belt Conveyors

Remote automatic control of mine hoisting system and belt conveyance system were installed, work efficiency was improved, and production safety was safeguarded through the use of this technique. This technique was honored with a 2nd class award for technological advancement by China Coal Group in 2006.

#### (8) Research and Application of Land Reclamation Technique

By making use of the research achievement from this project, a land area of 270 square kilometres at Pingshuo Mining Area was reclaimed, with the reclamation rate of 41%. The reclamation rate of dumping site exceeded 90%, and the coefficient for green land of the mining area was 25.2%, which has played an important role in building an environmental friendly mining area.