

conventional type, though some mines have introduced hydraulic drills jumbo. In the recent years, blasting techniques have improved with the use of ammonium nitrate based explosives. The bulk of the production comes from bord and pillar mining, though mechanisation of this is of a recent origin. The mining and allied equipment used are also of smaller size. For example, load-haul dumpers (LHD) are of the size of below 5m<sup>3</sup> and are mostly operated by energy-intensive diesel. Most of the mines continue with the technology introduced in mid-'70s and early '80s. In the last decade or more, little or no new technology has been imparted into the coal mining operations.

In contrast, the opencast mining technology is somewhat better, having been introduced later. Even here, the mining operations are carried out with shovels (power and hydraulic) of smaller capacity. Dumpers of over 100 ton capacity are few. Recently, however, the Piparwar mine (Bihar) has modern technology inducted with Australian assistance.

The need for increasing production to meet domestic demands at economical prices has necessitated a closer examination of the technological needs of India's mining sector.

### *Continuous Excavation*

Continuous excavation method is being successfully deployed at Neyveli lignite mines. Efforts are also being made to select coal mines amenable to the introduction of "Bucket Wheel Excavator" (BWE) system. At Niljai mine under Indo-German collaboration, continuous mining is to excavate top on soil and 30 m sandstone layer with BWE.

### *Combined Mining Systems*

Conventional mining equipment is being teamed with continuous transportation systems (usually a belt conveyor) to provide combined mining systems. For softer rocks, feeder breakers are used. In the coal mines, feeder breakers (manufactured by Ingersoll Rand, Bharat Westfalia, Larsen & Toubro (L&T), Eimco Elecon, etc.) are used to crush the large coal lumps followed by transportation by trucks or by conveyors.

The most modern coal mining and beneficiation complex of India at Piparwar owned by Central Coalfields Ltd. (CCL), an Indo-Australian joint venture, has been designed under collaboration with White Industries Ltd. having in-pit crushing and conveying system i.e. 'combined mining systems'. In addition to yielding higher productivity, this system will enable the mine to achieve an Output per Man Shift (OMS) of 31 t. The salient features of this 6.5 Mt ROM coal mine are presented in Table 1.