Case study: Development of a CMM power co-generation/emission abatement scheme – China

Initial conditions: A new surface gas extraction plant had been installed and completed in May 2007 at a remote 1,600 m mountain location above a coal mine with a coal production capacity of 5 Mtpa, a specific emission of 17.7 m^3/t, and draining methane at an average pure flow of 22 m^3/min. The overall mine methane capture efficiency was 15%, the remaining 85% being emitted with the ventilation air.

Gas control problems: Gas purity at the extraction plant was variable and sometimes less than the 30% minimum permitted for utilisation and gas capture efficiency. Drained gas quantities were expected to fluctuate due to variations in the longwall mining cycle and the phasing of workings in different seams; therefore, the CMM power plant capacity needed to be sized to ensure 85% availability to meet investment requirements. An aim of the project was to optimise energy recovery and minimise GHG emissions. An integrated engine and flare system was required—a first in China; therefore, technology transfer demands were expected to be high.

Solution: A team of local and international specialists in gas drainage and power and systems engineering were applied to the project to work with the mine staff to ensure gas delivery, scaling of project size, and plant integration and performance.

Methane purity was raised by improving the sealing and regulation of cross-measure boreholes. The gas capacity of the drainage infrastructure was increased, high-resistance flow monitoring devices were replaced, and a plan prepared for increasing gas capture. Intensive predrainage drilling on two future longwall panels provided enrichment gas and also supplemented flow eventually contributing 23% of the drained gas, the remainder coming from postdrainage, roof cross-measure boreholes. The latter were drilled ahead of the face and inevitably some suffered damage and performed badly once in the goaf. A demonstration borehole was drilled over the goaf behind the face, which performed well but the technique has not yet been adopted for local regulatory reasons, and this method of drainage has not been historically practiced in this region.

Phase 1 of the scheme involved installation of 5 MW_e with waste heat recovery for heating buildings and intake ventilation air in winter. A nominal 5,000 m^3/hour flare was also installed. A specialist company was engaged to devise and install a remote performance monitoring system for the utilisation and destruction equipment.

Once gas capture had been demonstrably increased to more than 50 m^3/min (pure), construction of Phase 2 was implemented in October 2009 to raise the power generation capacity to 12 MW_e.