

COAL MINE METHANE PROJECT OPPORTUNITY

Alashan Methane Recovery and Utilization Project

Lan Shan Coal Company, Tai Xi Coal Group

Xintai Industrial District, Inner Mongolia Autonomous Region, China

OVERVIEW OF COAL MINE METHANE PROJECT OPPORTUNITY:

The Gulaben mining area is in the North China platform tectonic fold belt of the north-central Helan Mountains near the town of Zongbieli. This area contains high quality anthracite coal in steeply dipping coal seams (45 to 90 degrees).

The Inner Mongolia Tai Xi Coal Group owns thirteen small closely spaced inactive underground mines in this area. Current underground activity consists of technical improvement work to ready one underground mine (the Song Shu Tan mine) for the safe recovery of up to 0.6 million tonnes of coal per year (Mt/year) by 2023. Other underground activity will be delayed and further development of surface mines will accelerate, producing up to 4.6 Mt/year.

Methane content of the primary seams average 18.2 cubic meters per tonne (m³/tonne). Specific emissions measured during previous mining ranged up to 69 m³/tonne of coal mined. In-mine long-hole drilling is being done in order to test the feasibility of pre-draining methane. Cross-measure boreholes will also be used to drain gas from gob areas.

The goal of this project is to consistently produce high-quality CMM through advanced CMM drainage technology that will be usable in power generation equipment (up to 5 MWe) as well as for town gas, boiler fuel and ventilation air heating.

ESTIMATED AVERAGE ANNUAL EMISSION REDUCTIONS: 90,000 TCO₂E

PROJECT DETAILS

- Name of project: Alashan Methane Recovery Project
- Name of mine: Song Shu Tan
- Type of ownership: Joint-stock
- Type of assessments performed: A feasibility study was prepared in 2011 with GMI funding
- Study performed by: HEL-East, Ruby Canyon Engineering, Inc., and ERG

MINE INFORMATION

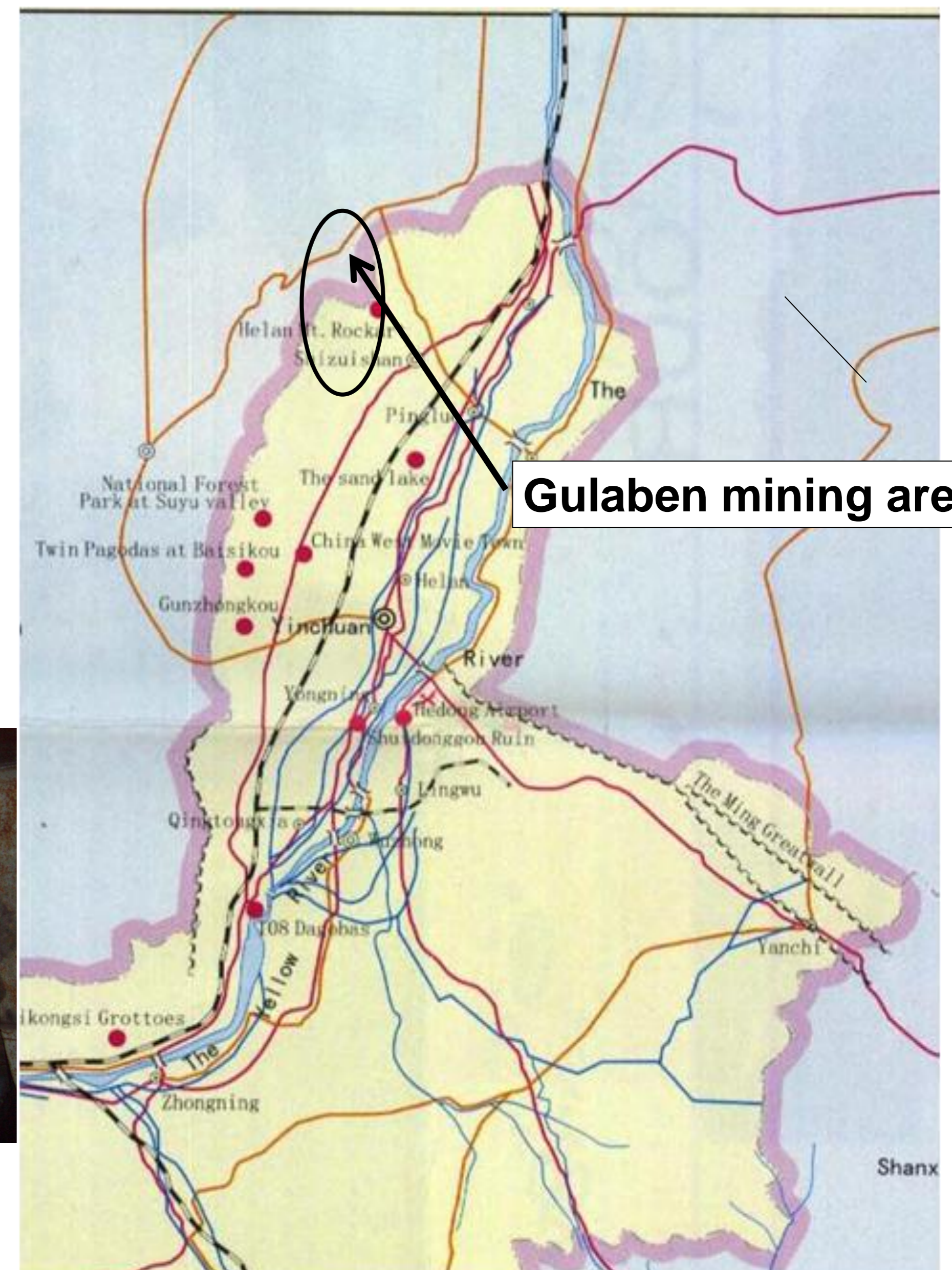
- Mine owner: Lan Shan Coal Company
- Parent company: Inner Mongolia Tai Xi Coal Group
- Status of mine: Technical improvement development
- Type of mine: Underground and surface
- Mining method: Short wall drill and blast with gravity recovery
- Service Life of Mine: Greater than 20 years

PROJECT FINANCES

- Assumptions : US\$ 67/MWhr, \$US 10/tCO₂e
- Estimated revenue : 10% NPV US\$ 5.5 Million
- Projected capital costs: US\$ 4.1 Million
- Projected operation and maintenance (O&M) costs for fully implemented project: US\$ 0.220 Million
- Estimated Return on Investment (ROI): 3 years



The Gulaben mining area is near the border with Ningxia Autonomous Region



Mine portal
← Tai Xi Coal Group Headquarters

HISTORICAL AND PROJECTED MINE DATA

The Tai Xi Coal Group has recently taken over a network of small coal mines, producing coal from the Gulaben mining area situated in the Helan mountains in Inner Mongolia. The group of mines is currently undergoing a program of technical safety improvement works, set for completion in 2023. At this time, coal production will commence and begin to ramp, reaching full production of 0.600 Mt/year from underground and 4.6 Mt/year from surface mines in 2023.

Currently, only trial coal production is occurring due to the technical improvement works. Very little historical coal production or gas drainage data is available following the recent wholesale purchase of the many small mines that form the conglomerate.

PROJECTED COAL PRODUCTION AND METHANE EMISSIONS

YEAR	2013	2014	2015	2016	2017	2018	2019
Surface Coal (tonnes/yr)	400,000	1,000,000	1,560,000	2,720,000	3,680,000	4,240,000	4,600,000
Underground Coal (tonnes/yr)	100,000	200,000	240,000	280,000	320,000	360,000	400,000
Methane (Mm³/yr)							
Emitted from ventilation system (VAM)	4.3	7.4	7.7	7.4	8.5	9.6	10.6
Liberated by drainage systems (CMM)	0.7	2.0	3.3	4.8	5.4	6.1	6.8
Vented to atmosphere	4.9	7.6	7.9	7.7	8.9	10.0	11.1
Total methane emissions	5.0	9.4	11.0	12.2	13.9	15.7	17.4

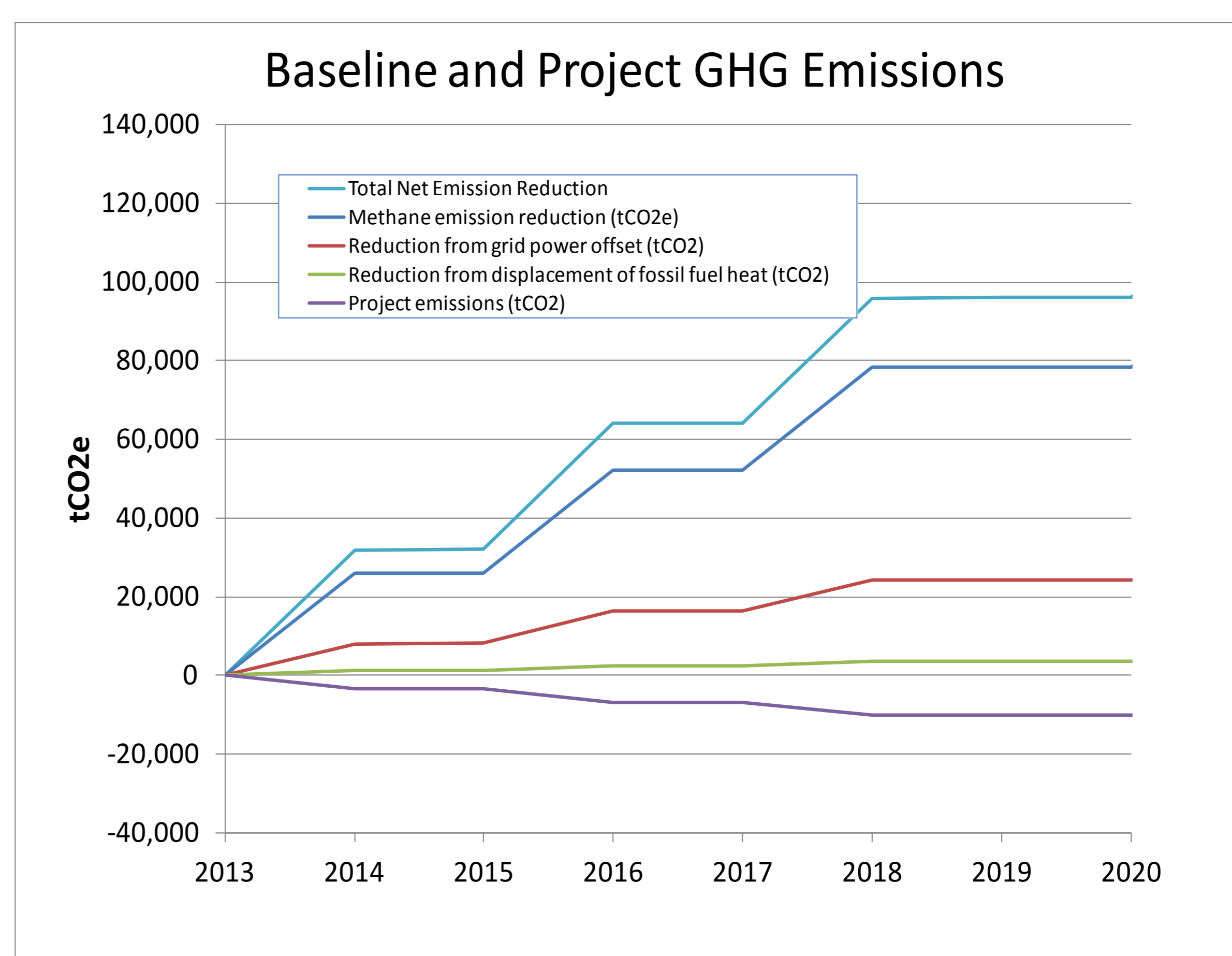
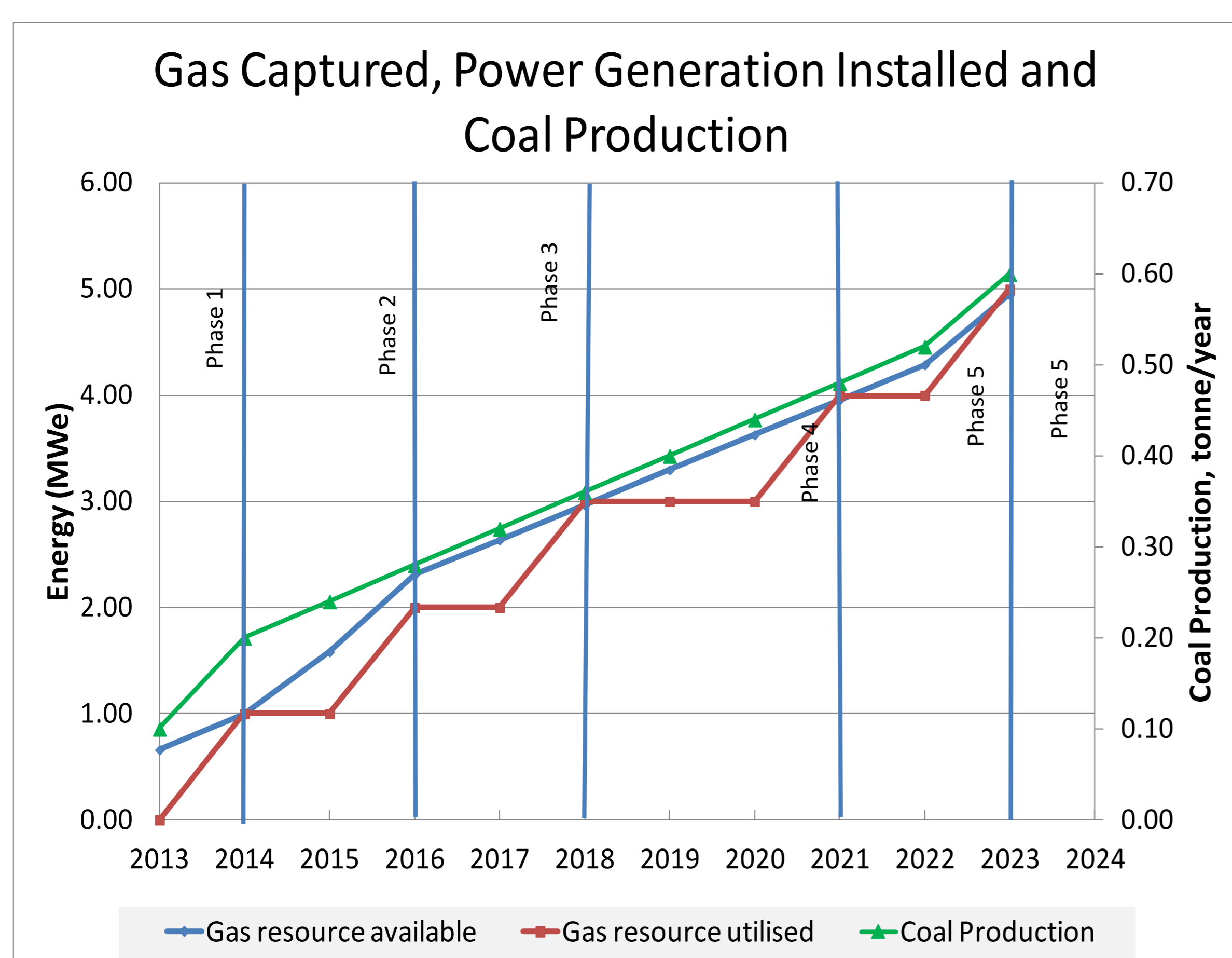
GREENHOUSE GAS EMISSION REDUCTIONS

The current methane usage scenario includes up to 5 megawatt electrical (Mwe) installed CHP genset capacity with most of the remaining gas being used for heat generation as either domestic fuel, shaft heating or as boiler fuel. Assuming 75% availability of the IC engines and 90% for the heat usage the following are estimates of the project GHG reductions in tonnes carbon dioxide equivalent (tCO₂e).

TOTAL VOLUME OF METHANE EXPECTED TO BE RECOVERED/UTILIZED

YEAR	2013	2014	2015	2016	2017	2018	2019
Total methane recovered and utilized (tCO ₂)	0	31,952	32,053	64,105	64,105	95,857	96,158
Methane vented or flared for operational reasons (tCO ₂)	7,786	650	14,664	9,085	16,871	1,949	9,735

COAL PRODUCTION AND METHANE EMISSION CHARTS



MARKET ANALYSIS / DEMAND ANALYSIS

A number of end use markets exist for utilization of the captured CMM. With annual temperatures averaging around 8°C there will be a high demand for district heating for the mineworkers' housing and associated mine buildings. It is expected that as the mining group reaches full production, more than 7,500 miners and service sector workers will be working and living in the Gulaben mining area.

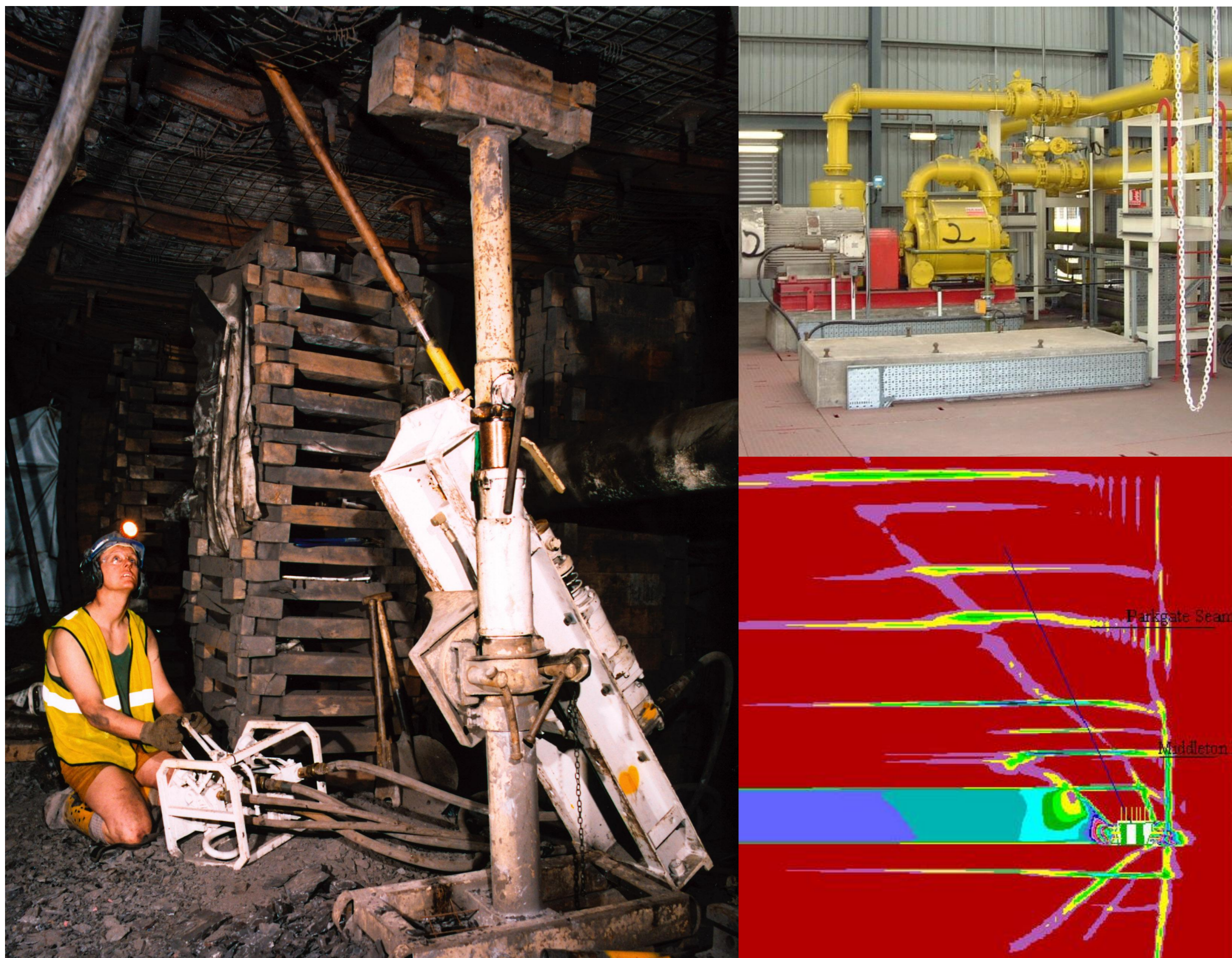
The existing waste coal fired thermal plant providing power to this area is expected to be running at full capacity by 2013 with no standby capacity and limited import facilities. Low water resources in the area means that constructing another thermal power plant is unfeasible, thus utilization of the drained CMM for power generation is synergetic with the development of the Tai Xi group.

Expected development of additional underground mines in the future will undoubtedly add to the power generation needs but will also supply those needs through gas drainage development. Up to 20 MWe is expected to be added based on future mine development.

TYPE OF ASSISTANCE SOUGHT

- Capital investment in plant and equipment
- Technical assistance in developing pre- and post-mining high quality methane drainage technologies

PROPOSED TECHNOLOGIES



Utilization of cross measures methane drainage boreholes that target the areas of fractured strata. The localized high permeability enables methane to migrate towards the working area. Capture of methane using surface extraction plants provides ease of methane utilization.



Combustion of drained methane in high efficiency CMM-fueled CHP generator sets and package boilers to provide sources of clean energy to satisfy the increasing energy demands of the rapidly developing Tai Xi mining group.

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