Yangquan Coal Company’s Shigang Coal Mine Methane Gas Purification/Liquefaction & Utilization Project

Yangquan, Shanxi Province, China

OVERVIEW OF COAL MINE METHANE PROJECT OPPORTUNITY:

The Shigang Coal Mine is located in Yangquan Coal Mining Area of east central Shanxi Province. The planned project will enrich coal mine methane to pipeline standards using low temperature gas liquefaction and separation technology. Large scale methane emission will be achieved in a large scale when the enriched methane is used as town gas. The project is expected to produce an annual emission reduction of up to 400,000 tonnes CO₂e. Yangquan Coal Mining Company constructed a CMM Purification/Liquefaction Test Station that has treating capacity of 4,300 m³/day and LNG production capacity of 1.22 tonne/day. This project offers an opportunity for project investors and service providers.

Yangquan Coal Company plans to expand the Shigang Coal Mine. The mine’s coal reserve block contains plentiful coal, coalbed, and coal mine methane resources. Surface gas extraction stations have been installed, with a total capacity up to 60 m³/minute. In 2006, the total volume of gas extracted was 5.26 Mm³. The Shigang Coal Mine plans to build additional gas extraction stations this year. When the new stations are put into operation, the maximum extracting capacity of the system will be increased to 1,000 m³/minute or greater. However, historically, all gas extracted at the Shigang Coal Mine was subsequently vented to the atmosphere.

The envisioned CMM use project would employ advanced low temperature CMM separation technology, removing the oxygen and nitrogen, thereby recovering the ultra pure natural gas products as LNG. With an anticipated capital investment of $7.5 million USD, the project would have an LNG production capacity of 20,000 t/a. Utilizing the purified LNG as town gas suppliants other fossil fuels resulting in significant reduction of carbon emissions.

MINE INFORMATION

- Status / Type of mine: Active / Underground
- Number of coal seams mined: 3 seams
- Mining Method: Longwall
- Gas Content: High

SITE DETAILS

- Condition of roads in area: Divided highway & Freeway
- Distance to nearest airport: ~70 kilometers to Taiyuan airport
- Additional project needs: funding for gas enrichment and LNG equipment

PROJECT DETAILS

- Potential type of project: CMM Purification/Liquefaction for Civil Use
- 20,000 t/year LNG output
- Use as town gas
MINE CHARACTERISTICS

COAL PRODUCTION
Shigang Mine

<table>
<thead>
<tr>
<th>Date mine started working</th>
<th>First started mining in 2004</th>
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<tbody>
<tr>
<td>Actual coal production in 2006</td>
<td>50,000</td>
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<tr>
<td>Proposed plans for Expansion</td>
<td>Coal production is estimated to reach 600,000 tonnes in 2008, 800,000 tonnes in 2009 and 900,000 tonnes in 2010</td>
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METHANE EMISSIONS

- Total volume of gas drained from mine: 25 m³/min
- Volume of pure methane in drained gas: 10 m³/min
- Average methane concentration in drained gas: 40%
- Fluctuation of methane concentration: 30-50%
- Total volume of gas drained: 5,260,000 m³ in 2006

- Total volume of ventilation air released: 1522 m³/min
- Volume of methane in ventilation air: 7.6 m³/min
- Average methane concentration in ventilation air: 0.5%
- Fluctuation of methane concentration: 0.4-0.6%
- Total volume of gas vented: 3,000,000 m³ in 2006

- Coal permeability: 0.5 md
- Coal in situ gas content: 13 m³/tonne

ESTIMATED EMISSIONS REDUCTIONS

The following estimated emissions will recovered and used by the proposed project:

- 25 Mm³ methane per year
- 400,000 tonnes CO₂e per year

Methane Emissions Expressed as CO₂e
PROJECT FINANCE NEEDS

• Financial Assistance
• Estimated total capital investment costs: $11.6 million USD
• Estimated total annual operating expenses: $4.5 million USD

SOCIO-ECONOMIC IMPACTS OF THE PROJECT

• The project will provide social benefits by significantly improving the health and safety for workers and residences and by providing a new source of clean electricity, decreasing coal-fired pollution emissions.

• The region will benefit with an improved air quality by addressing greenhouse gas emission and reducing emissions from mining activity, which is currently vented to the atmosphere.

CMM Purification/Liquefaction Pilot Project in
Yangquan Coal Mining Area

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