Perspectives, Obstacles and the Ongoing Development of CMM/CBM in Georgia
COMPANY PROFILE
GIG Group and Its Subsidiaries

With more than 4000 employed staff Georgian Industrial Group (GIG) is one of the largest industrial conglomerates in Georgia.

The business of GIG has been expanding quite steadily over the last years by means of acquisitions but also through organic growth e.g. by construction of new generation facilities such as power plants.

“One Team - Multiple Energies”
OUR ENERGY PORTFOLIO

Coal Mining
GIG owns and operates the only coal mine in Georgia with the 331 Mt coal extraction license. Tkibuli Coal mine envisages rising annual output up to 1 million tons by 2021.

Thermal Power Plants
The group owns and operates thermal power plants with a total installed capacity of 600 MW. A 300 MW coal fired power plant with modern combustion technology is currently under development.

Renewables
The company operates hydro power plants with a total installed capacity of 50 MW. GIG furthermore has some 70 MW of hydro and wind energy facilities under planning and development.

Electricity Trading
GIG and its subsidiaries are the largest electricity trader in Georgia handling export/import, transit and swap transactions with all of its neighboring countries.

CNG Refueling, Natural Gas Trading
Through its subsidiary NEOGAS, GIG owns and/or operates 20 CNG refueling stations across Georgia. Besides, GIG is involved in regional gas trading as well as wholesale trading in Georgia.
FURTHER INFORMATION: WWW.GIG.GE
TKIBULI-SHAORI COALFIELD
Location, Ownership and Reserves

Ownership
Saknakhshiri
GIG

Coal Exploration License
331 Mt

Reserves Defined by JORC Standards
500 Mt

Total Area
5,479.9 ha

Location
Tkibuli-Shaori Coalfield locates on the southern slope of the Great Caucasus in the Tkibuli and Ambrolauri Districts to the 200 km northeastward of the capital of Georgia Tbilisi.
Geology of the Tkibuli-Shaori Coal Region

The Coal Measures are composed of coals interbedded with shales and siltstones.

Typical total thickness of the Coal Measures is 50-60 m.

In the primary region, eight coal beds are recognized. From top to bottom they are as follows:

- **Stratum I** – 1 m.
- **Stratum II** – 3.95-7 m.
- **Stratum 7/4** – 2.5-4.5 m.
- **Stratum 0.8** – 0.8-3.5 m.
- **Stratum III.** – 2-7 m.
- **Stratum 0.9** – 0-3 m.
- **Stratum IV** – 4.5-10m
- **Stratum V** – 0.8-4 m.

Stratigraphy of the Main Coal-bearing Interval, Tkibuli-Shaori Region
Tkibuli-Shaori coal is a sort of volatile bituminous coal known as gaseous coal which contains considerable amount of Methane.

**Timeline**

1961
The first gas flew to the surface as a result of drilling of the borehole for research purposes.

From the year 1961 up to the late 1980s
34 bore holes were drilled and tested in order to determine methane content.
Late 1990s
By the end of 1990s due to the technical accident on the well, the gas extraction was stopped.

1961-1991
In total, more than 30 million cubic meters of methane was extracted from one experimental well K-1 without stimulation of the well.

THE FUTURE
The 45 years of evidence of experimental production proves that the potential for the development of CBM in Tkibuli-Shaori Coalfield is highly credible.
Recent studies on Gas-In-Place

- Methane resources: 70 billion $m^3$

- Estimated Reliability Ratio: $K=0.7$ (due to the high precession in terms of conducted studies)

- Totally approximately 49 billion $m^3$ of methane can be extracted from the coal bed and coal mines

Analysis also presented heavy hydrocarbon content such as: Ethane, Propane, Butane and Pentane. Gas in the deposit does not contain Sulphur.
**Methane Content**

Methane reproducibility from the coal is around 15 m³/tone and even increases with the depth of coal seams.

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**Thickness**

Thickness of the coal formation varies in the range 20-80m.

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**Permeability**

Unfortunately, there is no data available for the permeability, however, 30 years mining history proved that the permeability of Tkibuli coal should be at least 2 times higher than those of Donbas (Ukraine) and Kuzbass (Russia).

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**Porosity**

Tkibuli-Shaori coal is characterized by the high porosity which lies between 16% and 18%.

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**Depths**

The depth of coal seams varies in the range 800-1400m.
The study provides different scenarios of the volume production of Methane based on the different Permeability as well as outlines very rough assessment of Gas-in-Place (GIP). Unlike previous studies, for the purpose of GIP estimation, Methane content of only four coal seams are assessed. The simulation for scenarios was run by COMET 3 numerical software simulator.

### Gas in Place

<table>
<thead>
<tr>
<th>Area 1</th>
<th>Gas content (cf/ton)</th>
<th>Thickness (ft)</th>
<th>Area (acres)</th>
<th>Density (tons/acre-ft)</th>
<th>Gas in Place (Bcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seams III &amp; IV</td>
<td>242</td>
<td>40.2</td>
<td>5,225</td>
<td>2,160</td>
<td>110</td>
</tr>
<tr>
<td>Seams II &amp; 7/8</td>
<td>180</td>
<td>12.7</td>
<td>5,225</td>
<td>2,160</td>
<td>26</td>
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<tr>
<td>Total Gas in Place, Area 1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>136</td>
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</table>

<table>
<thead>
<tr>
<th>Area 2</th>
<th>Gas content (cf/ton)</th>
<th>Thickness (ft)</th>
<th>Area (acres)</th>
<th>Density (tons/acre-ft)</th>
<th>Gas in Place (Bcf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seams III &amp; IV</td>
<td>242</td>
<td>40.2</td>
<td>10,440</td>
<td>2,160</td>
<td>219</td>
</tr>
<tr>
<td>Seams II &amp; 7/8</td>
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<td>12.7</td>
<td>10,440</td>
<td>2,160</td>
<td>52</td>
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<tr>
<td>Total Gas in Place, Area 2:</td>
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<td></td>
<td></td>
<td></td>
<td>271</td>
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<tr>
<td>Total Gas in Place, Areas 1 &amp; 2:</td>
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<td></td>
<td></td>
<td></td>
<td>407</td>
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</tbody>
</table>

### Tkibuli-Shaori Type Well Simulation Results

<table>
<thead>
<tr>
<th>Permeability Case:</th>
<th>3 md</th>
<th>10 md</th>
<th>30 md</th>
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</thead>
<tbody>
<tr>
<td>Peak Gas Rate (mcfd)</td>
<td>92.9</td>
<td>295.7</td>
<td>702.5</td>
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<tr>
<td>Cumulative Gas Recovery (mmcf)</td>
<td>588.6</td>
<td>981.8</td>
<td>1,748.5</td>
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<tr>
<td>Gas Recovery (% of GIP)</td>
<td>32.4%</td>
<td>54.1%</td>
<td>64.2%</td>
</tr>
<tr>
<td>Peak Water Rate (bpd)</td>
<td>200.0</td>
<td>350.0</td>
<td>625.0</td>
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<tr>
<td>Cumulative Water Recovery (mbbl)</td>
<td>459.2</td>
<td>530.0</td>
<td>831.9</td>
</tr>
<tr>
<td>Water Recovery (% of WIP)</td>
<td>70.1%</td>
<td>80.9%</td>
<td>84.6%</td>
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</tbody>
</table>
GARDABANI COAL TPP: The Future Driver of Coal Production in Georgia

NOMINAL GROSS POWER OUTPUT: 300 MW, where 150MW is guaranteed capacity under Power Purchase Agreement;

COAL CONSUMPTION (per annum): Under 150MW operation (“PPA load”) – approximately 560 thousand tons design coal; Full load operation – approximately 890 thousand tons of design coal

COMISSIONING: According to the PPA signed between Electricity Market Commercial Operator and CPOWER (Subsidiary of GIG), the commissioning of the Coal TPP is projected in 2020
Projected Methane emissions data extrapolated from the Georgia’s Second National Communication to the UNFCCC where around 19 million $m^3$ CMM – 270 Kt CO2 equivalent - are estimated to have been emitted in 1990, at which time coal annual production was 960k tones.
Basically, the feasibility study should cover the following fields:

- Data acquisition and on-site investigations at coal mines;
- Independent forecast of total and utilisable gas emissions;
- Risk assessment;
- Basic engineering for gas drainage, mine ventilation and mine safety;
- Utilisation concept for power generation and methane abatement.

Depending on the type of revealed requirement, the feasibility study should also comprise of a certain field work, lab or in-situ tests such as core analysis, geophysical borehole logging, permeability and porosity tests, gas content and sorption isotherm tests, stress tests etc.
Possible Frameworks for Cooperation
Ideas for Future Cooperation

Feasibility Study Report on the Production of Coal from Flat Coal Seams – Ongoing Discussions, GIG and SCCG

Feasibility Study Report on CMM in Tkibuli, Recommendation Letter from GMI

What about ICE – CMM - Why Not?

Huge Interest from USAID toward CBM as a Future Pillar of Energy Security of Georgia
Thank You!

Questions?