



EPA Coalbed Methane Outreach Program Technical Options Series

## ***COAL MINE METHANE USE IN METHANOL PRODUCTION***



Sand Creek Chemical Plant in Commerce City, Colorado  
(uses conventional natural gas to produce methanol)

### ***A VIABLE SUBSTITUTE FOR CONVENTIONAL NATURAL GAS***

- ◆ The methanol market is robust and growing worldwide
- ◆ Methane from coal mines often costs less than conventional natural gas
- ◆ The use of coal mine methane reduces greenhouse gas emissions

*Coal mine methane may be an attractive alternative to conventional natural gas for small methanol plants*

## **Why Consider Coal Mine Methane in Methanol Production?**

**M**ethanol is a key component of many products, including MTBE (used in reformulated gasoline), methanol and gasoline blends such as M85 for flexible fuel vehicles, formaldehyde resins (widely used in the housing industry), and acetic acid, a major raw material in the chemical industry. MTBE (the second largest methanol market, after formaldehyde) is the fastest growing segment of the methanol market worldwide, due to its value as a clean burning fuel additive. The United States is the world's largest MTBE user, consuming approximately 40% of all methanol used for MTBE production on a global basis. Most of the world's production of methanol uses natural gas as a feedstock, and natural gas typically represents the most important cost component. Many countries produce methanol, although production tends to be concentrated in areas where natural gas is abundant.

For safety reasons, gassy underground coal mines must drain methane from their coal seams. Most coal mines vent this methane to the atmosphere, which not only represents the loss of a valuable fuel source, but also contributes to global warming, as methane is a potent greenhouse gas. However, a growing number of mines in many parts of the world recover the drained methane for sale to pipelines, or for heat or electricity generation. To date, no methanol producers have used coalbed methane, but it is a potential alternative feedstock in areas that mine gassy coal. Coal mines do not produce enough methane to fuel large methanol plants, but one or more very gassy mines typically produce enough methane to fuel a small (25-30 million gallons/year) methanol plant. Alternatively, smaller (3-5 million gallons/year) mobile methanol plants currently used at offshore oil rigs may be a potential option for use at coal mines.

*The cost of coal mine methane is often less than conventional natural gas*

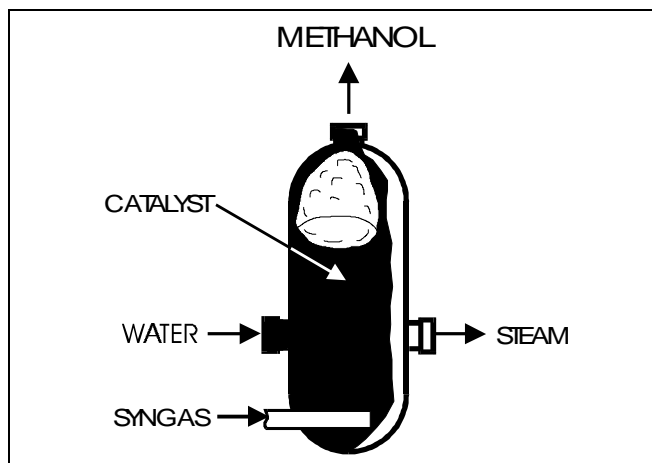
### **Some Facts About Methanol Production...**

- 100 ft<sup>3</sup> (2.83 m<sup>3</sup>) of methane will produce 1 gallon (3.8 liters) of methanol.
- Production costs are \$US 0.35-0.45/gallon (\$US 0.09/liter), assuming natural gas prices of \$2-\$3/mcf (\$0.70 - \$1.06/thousand m<sup>3</sup>). At \$2/mcf, natural gas typically accounts for about half of production costs at small plants.
- Typical 1997 methanol prices are around \$US 0.55-0.70/gallon (\$US 0.15-0.18/liter). Methanol prices can be volatile.
- Gassy mines are often located near methanol markets, potentially reducing transportation costs.
- Small plants produce 25-30 million gallons (95-114 million liters) per year. Methane requirements for small plants range from 7-8 million ft<sup>3</sup> (200-226 thousand m<sup>3</sup>) per day.
- Startup costs for a small plant are about \$US 1.33 million per million gallons of annual plant capacity (\$US 40 million for a 30 million gallon/yr plant).
- Gas quality should be at least 89% methane; up to 1% oxygen; and up to 10% CO<sub>2</sub> (a small amount of CO<sub>2</sub> is actually beneficial).

*The market for methanol is increasing worldwide*

## How is Methane Converted to Methanol?

The first step in producing methanol is converting methane to syngas, either by steam reforming methane and carbon dioxide, or by catalytic conversion of methane. (Conventional technologies for this part of the process can be expensive; however, several companies are developing new technologies to reduce this expense.) Next, a catalytic process converts syngas to crude methanol. Finally, distillation purifies the crude methanol to chemical grade.



Converting syngas to methanol

## For More Information...

Changing energy markets worldwide are prompting producers of coal and other fuels to look at new markets for coalbed methane. Coalbed methane is a potential feedstock for methanol and other products. Use of coalbed methane is also beneficial in that it also reduces emissions of this greenhouse gas to the atmosphere.

To obtain more information about methanol production, and uses of methanol for transportation, contact:

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**Or contact the U.S. EPA's Coalbed Methane Outreach Program for information about this and other profitable uses for coal mine methane:**

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<http://www.epa.gov/coalbed>

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