

The Potential of Renewable Natural Gas

January 7, 2009

Definitions

- Biogas:
 - Medium Btu, methane-rich gas (with impurities) produced from organic material
- Biomethane or Renewable Natural Gas:
 - Pipeline-quality natural gas substitute produced by purifying biogas

Sources of Biogas

- Naturally produced via anaerobic digestion in:
 - Landfills
 - Animal lagoons
 - Sewage ponds
- Produced in anaerobic digesters from:
 - Animal waste
 - Sewage
 - Crop waste
 - Organic commercial/industrial waste
- Produced via pyrolysis from:
 - Cellulosic crops (e.g., switchgrass)

Disposition of Naturally Occurring Biogas

- Vented
- Flared
- Use it as energy:
 - Combusted on-site for heat or power generation
 - Purified into biomethane:
 - Used on-site
 - Injected into nearby natural gas pipeline
 - Trucked offsite (as CNG or LNG)

Implications of Disposing of Biogas

- Economic
- Energy efficiency (energy independence)
- Greenhouse gas

Greenhouse Implications of Biogas Disposal

- Vented:
 - Methane has 21 times the greenhouse gas impact of CO₂
 - Huge greenhouse gas impact
- Flared:
 - Converted to CO₂
 - Same impact as using natural gas (without useful work)
- Used:
 - Displaces otherwise-used fossil fuel
 - Significant greenhouse gas reduction

GHG Emissions*:

Natural Gas vs. Gasoline

(in pounds per gasoline-gallon-equivalent)

Gasoline about 44% more GHG
than natural gas

26



Gasoline

18



Natural Gas

* Full-fuel cycle CO₂ equivalent emissions

GHG Emissions*:

Flared Landfill Gas vs. Gasoline (in pounds per gasoline-gallon-equivalent)

Gasoline produces about 110% more GHG than biogas that would have been flared



* Full-fuel cycle CO₂ equivalent emissions

GHG Emissions*:

Vented Landfill Gas vs. Gasoline (in pounds per gasoline-gallon-equivalent)

Gasoline produces about 623% more GHG than biogas that would have been vented



* Full-fuel cycle CO₂ equivalent emissions

Biomethane Potential

- 1998 DOE study (QSS):
 - In the U.S., feasible to capture and use about 1.25 quadrillion Btu from landfills, animal waste and sewage *alone*
- This is equivalent to 6 percent of all the natural gas used in the U.S.
 - If all used in transportation, would displace 10 *billion* gallons of gasoline per year.

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Biomethane Potential

- Potential for cellulosic biomethane almost unlimited
- Europe (especially Sweden) leading the way:
 - Sweden's goal: to displace all natural gas use with biomethane and all gasoline and diesel with renewable fuel (including biomethane)
- European studies conclude that cellulosic biomethane production is far more energy efficient and less costly than other cellulosic energy -- today

Current US Biomethane Projects

- California: Prometheus Energy producing LNG from LFG and trucking to OCTA for use in buses.
- Ohio: FirmGreen producing CNG from LFG and using it to power municipal fleet.
- Texas/California: Microgy producing biomethane from animal waste and selling it to PG&E to help meet RPS
- Idaho: Intrepid Technologies producing biomethane from animal waste; Has contract to sell injected gas to utility

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Current US Biomethane Projects

- California: Linde (with Waste Management) producing LNG from LFG
- Texas: Clean Energy to produce biomethane from LFG and use it to displace natural gas at their fueling stations.

Federal Barriers to Biomethane Growth

- Federal biogas tax credit:
 - 1.9 cents per KWH (\$5.66 per MMBtu) for electricity produced on-site from biogas
 - All other uses of biogas (including biomethane in vehicles and producing electricity off-site) do not qualify
- Agencies' focus on liquid cellulosic and non-cellulosic renewable fuels:
 - e.g.,: December 23 DOE Fed. Reg. notice for a reverse auction program to provide payments to cellulosic biofuels. Only liquid fuels eligible.

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