Renewable Natural Gas (RNG) and RINs

New Rules, New Opportunities

Marianne Mintz
Argonne National Laboratory
June 29, 2015
Renewable Natural Gas: New Rules, New Opportunities

- Overview (Why RNG?)
  - RNG composition and source
  - RNG production
  - Clean Cities and RNG

- Advantages of RNG (Why Now?)
  - Environmental benefits
  - Incentives and other funding sources
What is RNG (biomethane)?

- A renewable source of methane, the primary constituent in natural gas
- Produced from breakdown of organics (MSW, yard/food waste, sewage, manure) in absence of oxygen (anaerobic digestion)
- Biogas (or LFG) is purified to remove contaminants (primarily CO2 and H2S)
- Following purification, RNG contains >90% methane
- RNG is comparable to fossil natural gas. RNG CAN BE USED IN ANY NATURAL GAS-FUELED ENGINE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Tariff Values for Natural Gas</th>
<th>High-BTU Landfill Gas (purified)</th>
<th>Raw Biogas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Htg Value: avg range</td>
<td>Btu/SCF</td>
<td>1050 900-1200</td>
<td>970 930-1010</td>
<td>615 498-697</td>
</tr>
<tr>
<td>Wobbe No:</td>
<td>Btu/SCF</td>
<td>1340</td>
<td>1275</td>
<td>644</td>
</tr>
<tr>
<td>Methane:</td>
<td>% comp.</td>
<td>not reported</td>
<td>90+</td>
<td>60</td>
</tr>
<tr>
<td>Carbon Dioxide:</td>
<td>% comp.</td>
<td>0-3</td>
<td>0-2.2</td>
<td>28.6-40.4</td>
</tr>
<tr>
<td>Nitrogen:</td>
<td>% comp.</td>
<td>0-4</td>
<td>0.5-6</td>
<td>0.6-12.7</td>
</tr>
<tr>
<td>Oxygen:</td>
<td>% comp.</td>
<td>0-1</td>
<td>0.1-0.9</td>
<td>0.2-2.9</td>
</tr>
<tr>
<td>Hydrogen:</td>
<td>% comp.</td>
<td>0-0.1</td>
<td>BDL-0.9</td>
<td>-</td>
</tr>
<tr>
<td>Siloxanes:</td>
<td>mg Si/m^3</td>
<td>not reported</td>
<td>BDL-0.4</td>
<td>-</td>
</tr>
<tr>
<td>Hydrogen Sulfide:</td>
<td>ppmv</td>
<td>0-15.3</td>
<td>BDL</td>
<td>1480-6570</td>
</tr>
<tr>
<td>Total Sulfur:</td>
<td>ppmv</td>
<td>0-338</td>
<td>BDL-5.1</td>
<td>0.3-6580</td>
</tr>
</tbody>
</table>

Source: Gas Technology Institute, 2009 and 2012.
RNG can close the renewable loop

Food scrap/organic waste to stand-alone AD example

WWT- and livestock-based RNG skip collection, some processing

Courtesy Hitachi Zosen Inova (www.hz-inova.com)
RNG projects can be complex

- Multiple “players”, for example:
  - Waste generators
    - Residences
    - Commercial establishments, institutions
    - Food processors, dairies/CAFOs
  - Waste handlers/collectors (MSW, FOG, etc.)
    - Disposal companies
    - Contract haulers
  - Waste managers
    - Disposal facilities (landfills)
    - Resource reclamation facilities (WWTPs, MRFs, composters)
    - AD operators
  - Offtakers (utilities, RNG/by-product purchasers)
  - 3rd parties
- Multiple regulations/regulatory authorities
- Often long lead times and high capital cost
Clean Cities has supported RNG through local coalition efforts

For example:

- Fair Oaks Dairies (IN)
- Pierce Transit & SEA-TAC Airport (WA)
- Solid Waste Association of Central Ohio
- Quasar Energy (OH)
- Waste Management/Altamont Landfill (CA)
- Atlas Disposal/South Transfer Station (CA)
- Etc…….

Operational RNG project with Clean Cities support
- DeKalb Co. Sanitation Dept./Seminole Rd Landfill (GA, ARRA)
  [Link](https://www.youtube.com/watch?v=DRRz7Fl4ZBg)

- Clean Cities Strategic Planning (2009)
  - Renewable Natural Gas: Current Status, Challenges and Issues
    [Link](http://www1.eere.energy.gov/cleancities/pdfs/renewable_natural_gas.pdf)

  [Link](http://www1.eere.energy.gov/cleancities/waste_to_wheels.html)

- NGV Technology Forum (2014)
  [Link](http://www1.eere.energy.gov/cleancities/natural_gas_forum_meeting_jan2014.html)

- Clean Cities Strategic Planning (2015)
  - Status and Issues for Natural Gas in the United States
    [Link](http://www1.eere.energy.gov/cleancities/pdfs/2015_strategic_planning_natural_gas.pdf)
  - RNG toolkit (under development)
  - Case studies (under development)
  - RNG project data base (Sept. 2015)

- Alternative Fuels Data Center: Emerging Alternative Fuels
  [Link](http://www.afdc.energy.gov/fuels/emerging_biogas.html)

- State, national and international stakeholder outreach
Why is RNG important now?

- “Greens” the natural gas grid
- Enables continued natural gas uptake (and petroleum displacement) in transportation
- Furthers environmental initiatives and mandates
RNG can “green” fossil natural gas

- RNG can achieve 83–98% GHG reductions over gasoline, though results vary with climate, technology, pathway (especially distribution) and reference assumption.
- An 80/20 blend reduces GHGs by 30–33%: a 90/10 blend by 19–25%.
- GREET 2015 will update methane leakage, petroleum composition, RNG pathways.

Source: J. Han, Argonne National Laboratory, GREET 2015 (forthcoming).
RNG can enable natural gas uptake

- Historically, natural gas & oil prices were “coupled”
- Price & new technology spurred exploration, production & new supply
- Shale gas “revolution” (2006-09) uncoupled prices
- In past 5 years, ARRA & price advantage spurred NG penetration and doubled number of stations
- Now, price advantage is less & station additions down (20-30 to 10-20/mo)
RNG supports climate/environment initiatives and qualifies for incentives

- USDA/EPA/DOE Biogas Opportunities Roadmap
- USDA grants & loan guarantees
  - Biorefinery assistance
  - Building Blocks for Climate Action
    - Livestock partnerships: 500 digesters by 2025
    - Energy generation and efficiency: REAP
- CA Low Carbon Fuel Standard (LCFS)
  - Fossil natural gas may not qualify as LCF
    - Revised leakage estimates
    - Methane’s climate-forcing effect greater than prior estimates, especially in near term
- Renewable Fuel Standard (RFS)
  - RNG qualifies as cellulosic biofuel, eligible for associated renewable identification no. (RIN)
Though few projects currently produce RNG, interest is growing

- <40 landfills converting WTE currently produce RNG
- As a “cellulosic biofuel” RNG production is eligible for higher value RFS incentives (D 3 RIN ~ $0.80/dge in 2014) and expected to experience increasing demand

RNG = 98% of 2014 cellulosic biofuel RINS
- RINs make RNG more competitive with fossil NG & petroleum
- State & local bans of organic waste from landfills
- Potential state renewable gas standards, LCFS

And so can production

Plentiful resources:

- **Waste-in-place:** 440 candidate landfills could produce another 475 mmscfd (>500 million gge/yr) plus many of 645 landfills with existing WTE projects could increase production.

- **“New” waste:** Americans dump nearly 450 million lbs of municipal solid waste in landfills every year.

- 160 billion lbs (~50% US food production) is uneaten each year.

- RNG can be produced from food waste alone or co-digested in WWTPs or stand-alone anaerobic digesters.

*Source*: USEPA, Landfill Methane Outreach Program ([http://www.epa.gov/lmop/](http://www.epa.gov/lmop/)).
Thank You

mmintz@anl.gov

This work was supported by the Clean Cities Program in the USDOE’s Office of Energy Efficiency and Renewable Energy, under Contract DE-AC02-06CH11357. We thank Linda Bluestein and Dennis Smith for their support.