What’s Worth More: A Cow’s Milk or its Poop?

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Two Sources of Methane from Dairy Cattle

Enteric Fermentation
• Microbial fermentation in the rumen produces methane

Manure Decomposition
• Anaerobic lagoons are the least-expensive way to handle manure in concentrated dairy operations
  • Anaerobic decomposition produces methane
  • Digesters capture methane ✔
  • Captured gas can be used for transportation place of fossil gas ✔

• Equal emissions from the two sources if manure processed in lagoons
Two Government Programs Give Credit for Capturing Methane in Digesters

**Federal Renewable Fuel Standard (RFS)**
- Subsidy per MMBTU depends on price of RIN credits

**CA Low Carbon Fuel Standard (LCFS)**
- Subsidy depends on price of LCFS credits and estimated carbon intensity

In addition, various grant programs contribute to capital costs of digester projects
LCFS subsidies were large through 2021
Number of Operating Dairy Anaerobic Digesters in the US

Source: EPA Agstar database
RFS and LCFS Subsidies are Thousands per Cow

<table>
<thead>
<tr>
<th></th>
<th>Market Prices</th>
<th>Subsidies</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Nat Gas</td>
<td>RIN</td>
</tr>
<tr>
<td></td>
<td>$/MMBTU</td>
<td>$/gal</td>
</tr>
<tr>
<td>2021 Q3</td>
<td>5</td>
<td>3.00</td>
</tr>
<tr>
<td>Today</td>
<td>5</td>
<td>3.10</td>
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</tbody>
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**Assumptions**

Biogas Cl = -300

Biogas production = 22.5 MMBTU/cow
What Was Worth More in 2021 Q3?

Assumptions

- Herd size = 2000 cows
- Discount rate = 0.07
- Capital cost = $4.8m
- Operating cost = $294/cow
- Alt cap. cost = $3m
- Alt op. cost = $563/cow
- LCFS price = $185/MT
- RIN price = $3.00/gal
- NG price = $5/MMBTU
- Gas prod = 22.5 MMBTU/cow
- Biogas CI = -300
- Milk prod = 230 cwt/cow
- Milk price = $20/cwt
- Capital cost amortized over 10 years
- Costs from my blog
- Alt. costs from Myers Jaffe (2015)
What’s Worth More Today?

**Assumptions**
- Herd size = 2000 cows
- Discount rate = 0.07
- Capital cost = $4.8m
- Operating cost = $294/cow
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- Gas prod = 22.5 MMBTU/cow
- Biogas CI = -300
- Milk prod = 230 cwt/cow
- Milk price = $24/cwt

Capital cost amortized over 10 years
Costs from my blog
Alt. costs from Myers Jaffe (2015)
Conclusions

• LCFS and RFS subsidies are large – will farmers begin to farm methane rather than milk?

• Incentives for further intensification of beef, dairy, and hogs throughout the country

• LCFS credit price might go up again