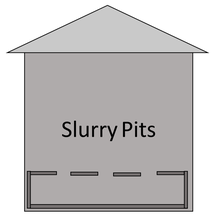
Renewable Natural Gas from Swine Waste: Responsible Solution or Greenwashing?

Matthew Price, Department of Environment, Ecology, and Energy

Introduction

In Duplin County alone, there are over 2 million hogs across 500 farms. Historically, farmers in North Carolina have used lagoons as a means to hold waste produced by hogs. In the past few years, researchers have studied and helped implement ways to convert hog waste into renewable natural gas via a natural process that occurs when organic matter breaks down.



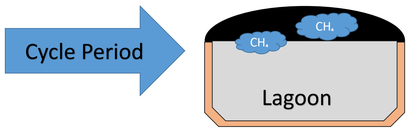


Figure 1, Feeder-Finish farms raise swine from . Swine in a hog lot produce waste that is captured in a slurry pit. Slurry pits are cycled on a period of either 7, 15, or 30 days. Waste arrives in the lagoon system, where CH_4 is captured.

Methods

I developed a model that takes hog population data for a particular farm and estimates the potential biomethane generation that occurs in a slurry pit and lagoon.

$$MPR = (VS_d + 0.01\,VS_{nd}) * A * EXP(-Ea/RT)$$

MPR is the Methane Production Rate (g CH_4 /day), VS_d and VS_{nd} are volatile solids that are degradable and non degradable respectfully (kg), A, is an Arrhenius parameter(g CH_4/VS kg/hr.), Ea, activation energy (J/mol), R, gas constant (J/K/mol), T, temperature (K). [1]

Feeder-Finish farms on average produce 0.52 kg VS/day/hog, [2] from that 51% is degradable and 49% is non degradable. [3]

Conclusion

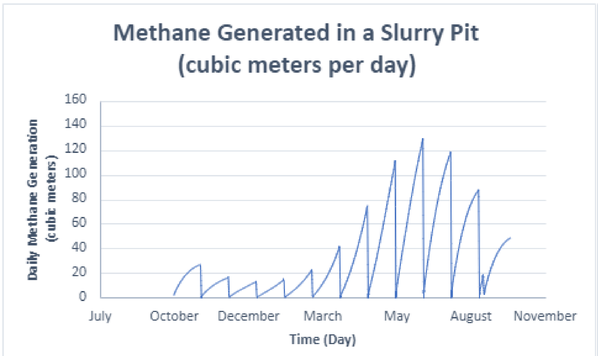
15% of CH_4 is lost when waste is in slurry pits for 30 days. Cycling from the slurry pit on a basis of 7 or 15 days, compared to the 30 days, allows for greater retention; and only ***5% or 8% losses in methane*** respectively.

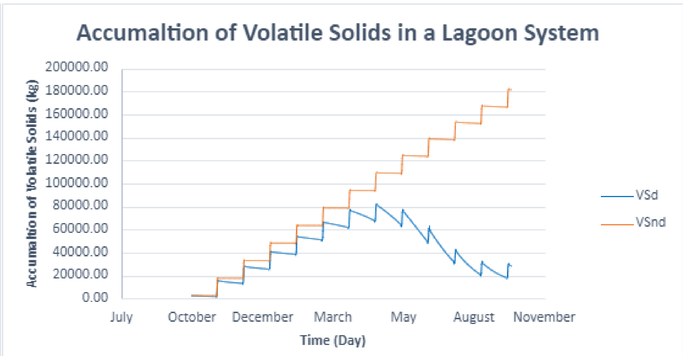
- The lowest estimate is ***47,027,129 m^3 CH_4.***
- ***10.52 MMT CO_2e*** produced annually by North Carolina's Agriculture Industry as of 2018. [4]
- ***96.5 mt CO_2e*** reduced through the capture of CH_4 from lagoons.

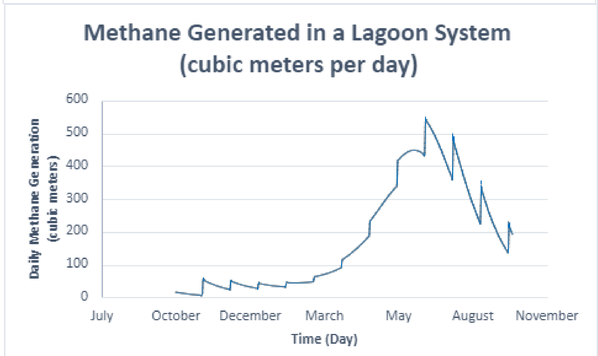
Limitations:

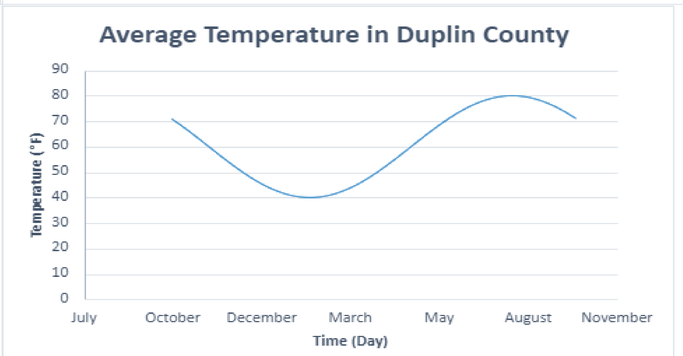
- The model uses a static value for A, which is derived from experiments conducted in Denmark.
- Hog farms impact low income and minority communities the most, and CH_4 capture reduces the effects, it does not eliminant them.

Results









Map

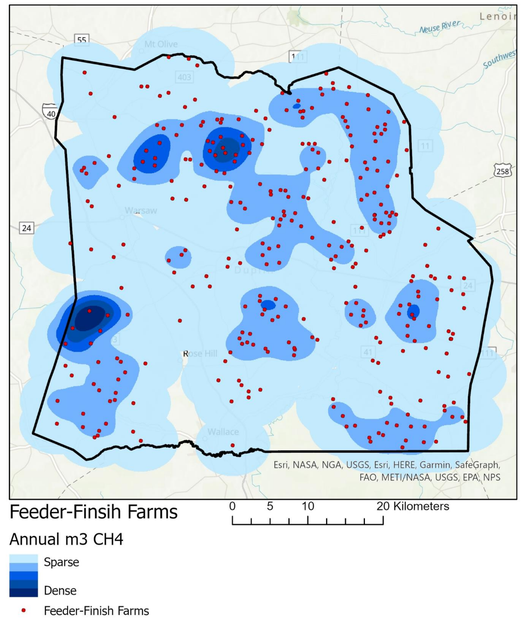


Figure 2, the annual methane production for Feeder-Finish farms in Duplin county. The areas with the most dense location of farms have the largest potential to receive the benefits of implementing renewable natural gas projects due to CH_4 production.

References

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