Climate Change VS. Smog

The Story

- California Dairy Farmer, John Fiscalini, has installed a methane capturing system that generates enough energy to sustain his farm.
- Methane capturing dairy farms in San Joaquin Valley being shut down.
- The combustion engine used to generate the electricity contributes to smog.
- The Federal air quality regulations in California over their limits, making the cut back of smog more important than reduction of climate change.
- NOx is associated with combustion engines like the methane generated engines on the dairy farm.
- NOx regulations are 11ppm
- NOx makes PM and ozone
- Animal Husbandry produces CH4 and Ammonia a precursor to particulate matter
- According to a news source Methane generators potentially:
  - Reduce H2S, VOC, and PM (How?)
  - Reduces Odor
- Point source Vs. Nonpoint source issue
- The installation of the generators on Fiscalini’s farm costs 4 million dollars.
- The additional pollution controls on Fiscalini’s farm cost 200,000 dollars.
- 2009 six generators shut down
- Produce less NOx than coal power plants, but no coal power plants are in the San Valley Air Pollution Control District
- San Joaquin Valley rules say need Best Available Control Technology for the area
- San Joaquin Valley Air Pollution Control district is targeting reduction in VOC and NOx

Textbook Chemistry

- Troposphere:
  - Oxidation of CH4
    - O’D +H2O->OH +OH
    - OH +CH4->CH3+H2O
    - CH3+O2+M-> CH3O2+M
    - CH3O2 +HO2-> CH4O2+O2 (dissolves in rain)
    - CH3O2 + NO-> CH3O + NO2 (preserves radical while also a source for NO2)
    - CH3O+O2-> CH2O + HO2
    - CH2O+ hv-> H+ HCO
    - HCO+ O2-> CO + HO2
  - NOx production of Ozone
    - NO2+hv-> O +NO
    - O + O2+ M -> O3 + M
- $\text{OH} + \text{CO} \rightarrow \text{H} + \text{CO}_2$
- $\text{H} + \text{O}_2 + \text{M} \rightarrow \text{HO}_2 + \text{M}$
- $\text{HO}_2 + \text{NO} \rightarrow \text{OH} + \text{NO}_2$ (production of ozone and source for NO2)
- $\text{NO}_2 + \text{O}_3 \rightarrow \text{NO}_3 + \text{O}_2$ (sink for ozone, but NO3 photolysis during day)
  - Peroxyacetyl nitrate (PAN)
    - $\text{CH}_3\text{COO}_2(\text{water soluble}) + \text{NO}_2 \rightarrow \text{CH}_3\text{COO}_2\text{NO}_2$ (PAN found in photochemical smog)
    - PAN can cause asthma, chest pain, headaches, coughing, asthma attacks
  - Heterogeneous Nox chemistry
    - $\text{NH}_3(\text{g}) + \text{HNO}_3(\text{g}) \rightarrow \text{NH}_4\text{NO}_3(\text{s})$
    - $\text{NaCl} + \text{HNO}_3 \rightarrow \text{HCl(g)} + \text{NaNO}_3$ (condensation)
- CH4 a Green House Gas
  - Long wavelength energy absorbed by CH4 increasing global temperature
Bibliography


