



Sustainable Conservation

Biofuels – Why Now and What Are the Opportunities?

-Presented by Allen Dusault

Biofuels Are Derived Primarily from Plant and Animal Material



Biogas/Biomethane

- Methane from anaerobic decomposition
- Substitutes for either diesel or gasoline



Biodiesel

- Vegetable oils or animal fats
- Biodiesel substitutes for diesel



Ethanol

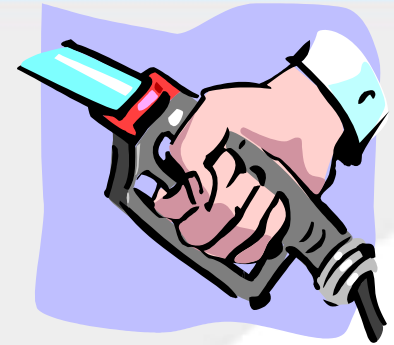
- From corn but potentially other crops
- Substitutes for gasoline
- 5.7% as oxygenate in CA

Almost all biofuels production is out of state



Biofuels Potential

- Major sectors include
 - Diesel vehicles (trucks)
 - Gasoline vehicles (cars)
 - Natural gas vehicles (new buses)
- Meet 10-20% supply over next 20 yrs?
- Depends on regulatory certainty, investment & incentives
- California has not made that investment

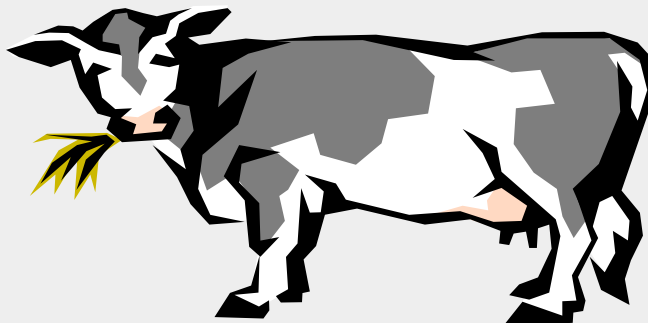


Biogas/Biomethane: Energy from Anaerobic Decomposition

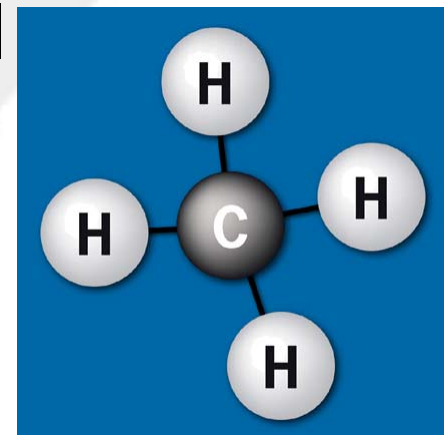
- Many potential sources of biogas
 - On farm manure in anaerobic digesters
 - Sanitary landfills or garbage
 - Industrial and municipal wastes
 - Agricultural plant waste
 - Food processing waste
- Needs to be upgraded for fuel



Methane

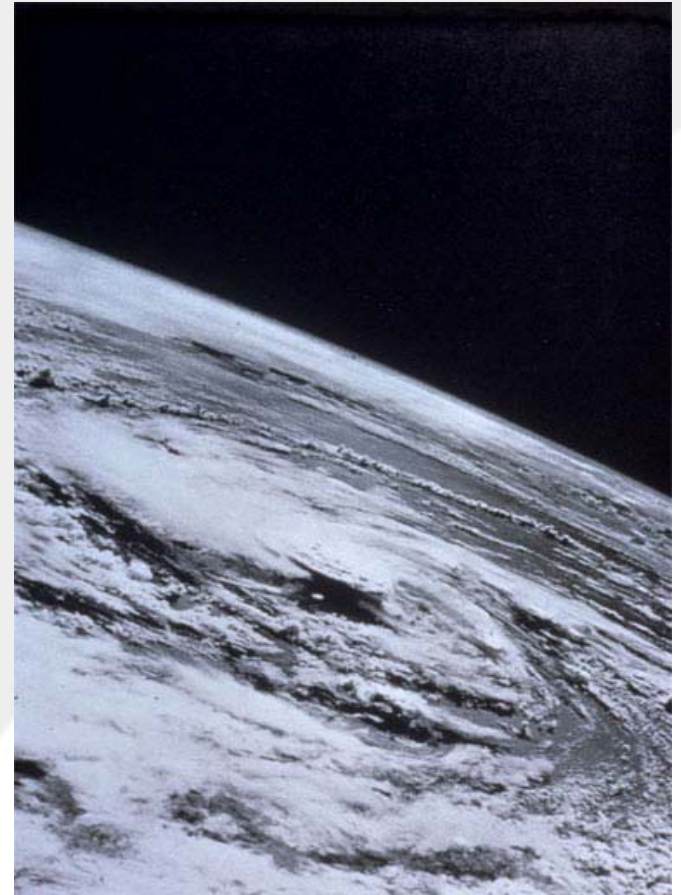


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Biomethane: Key Benefits

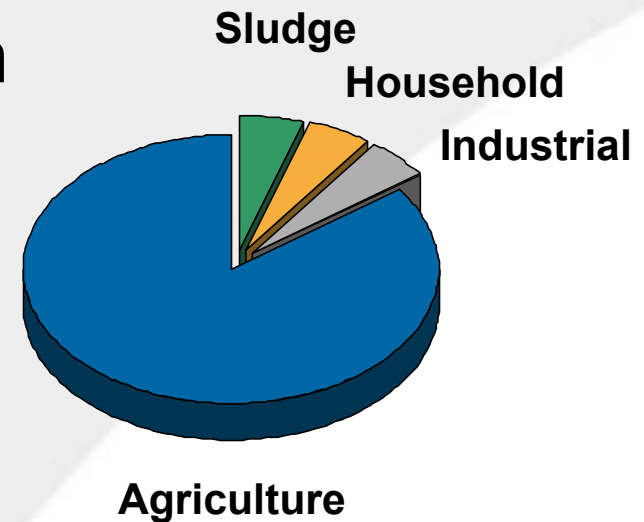
- Lowers air pollution (vs. diesel)
- Anticipates hydrogen
- Negative GHGs using current sources
- Use existing infrastructure?



Sweden Biogas Industry

World leader in fuel production

- 17 biogas plants
- 24 biogas refueling stations
- 20 biogas/NG refueling stations
- >4,500 NG bi-fuel vehicles
- Potential to meet transportation 20% of demand



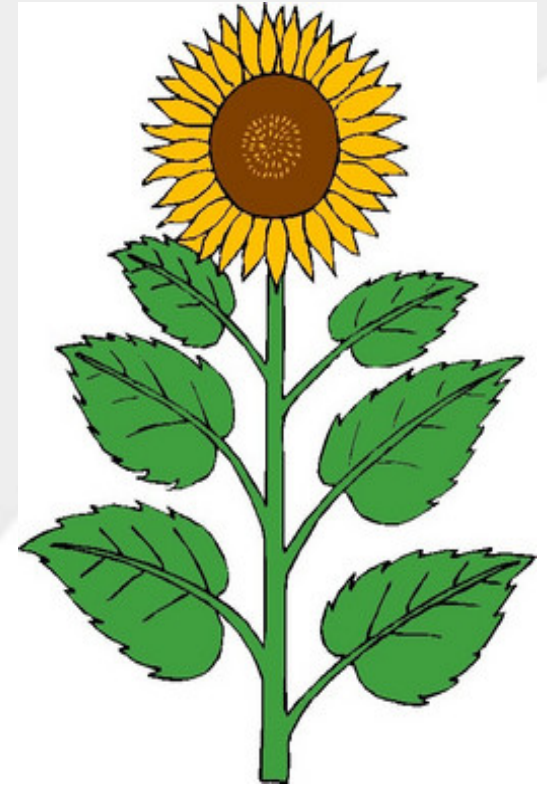
Biomethane: Potential for CA

- Biomethane vehicles (CNG)
- Potential diesel replacement
- Carbon neutral fuel goal
 - 5% blend with CNG?
- Need to create new industry



Biodiesel: Fuel Typically from Vegetable Oils or Animal Fats

- Use in diesel engines
- Soybean oil most common
- Usually blended with diesel (B5, B20, etc.)
- CA grows almost none



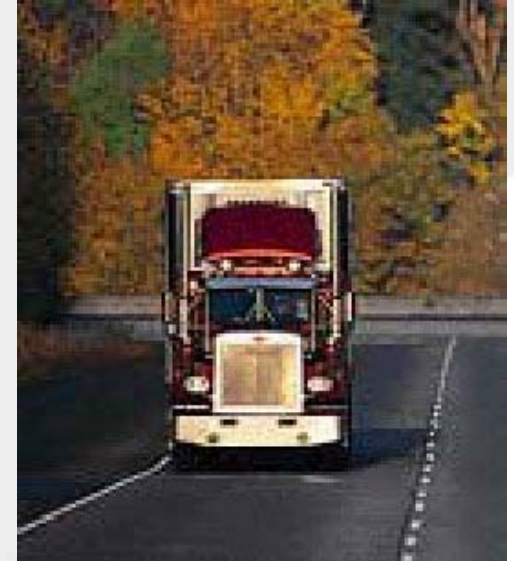
Biodiesel: Key Benefits

- Lower emission of most air pollutants
- Highest net energy yield: ~ 3:1
- Low greenhouse gas emissions
- Can use existing infrastructure

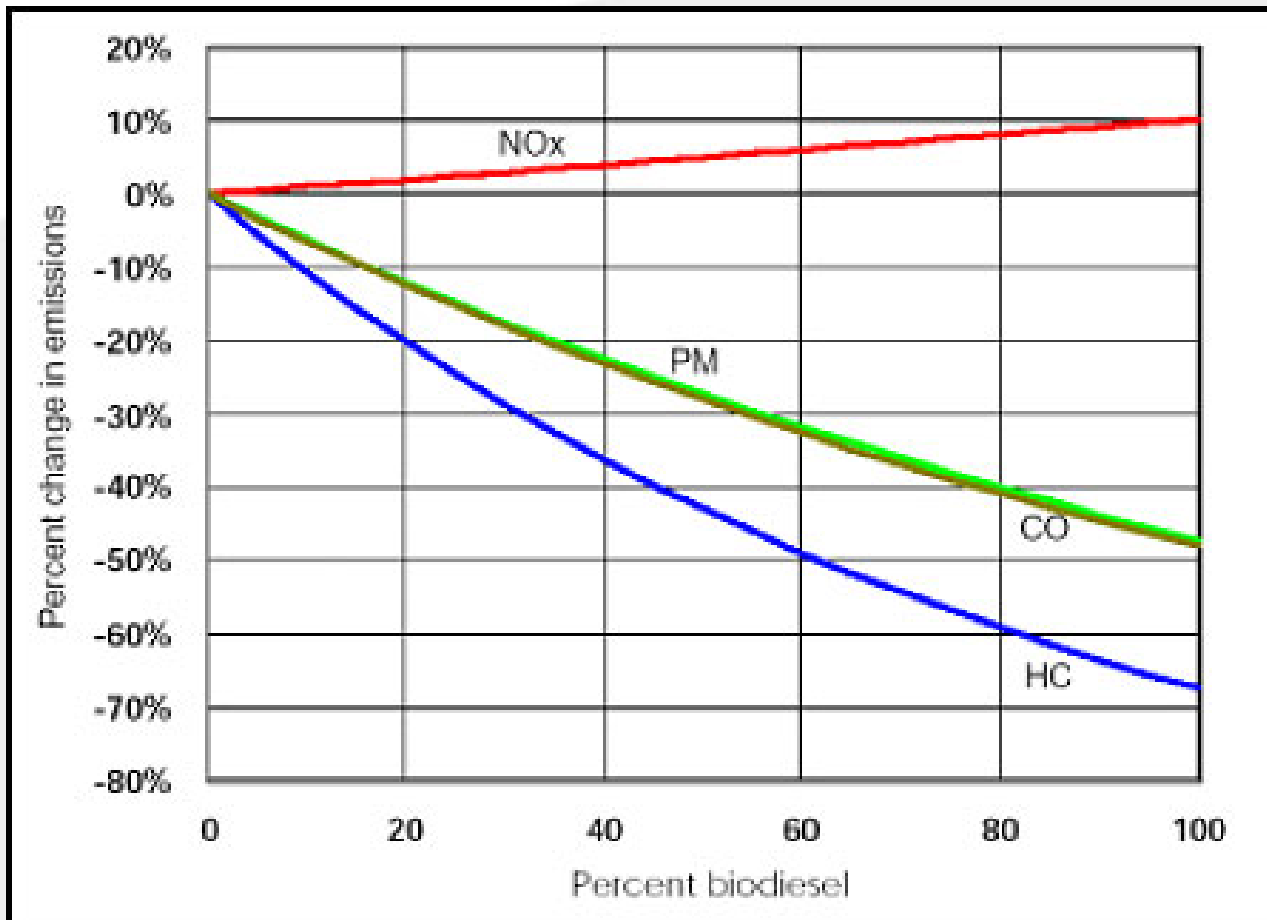


Biodiesel Potential to Replace Highway Diesel

- CA consumes 190,000 barrels/day of diesel
- Approx 10% biodiesel as replacement feasible
- Feedstock for CA biodiesel comes from out of State
- How much can grow in CA?



Key Issue: NOx



Biodiesel Possibilities

- NOx can be reduced to at or below diesel
- Grow CA non-GMO crops
 - Canola, Mustard, Sunflower
 - Crop rotations and conservation tillage
- B5 has negligible NOx impact
- Should we make from CA crop?



Ethanol Current Production

- Ethanol fermentation from Midwest corn
- 12% of automotive fuel has some ethanol
- 7% of corn crop being grown for fuel
- 2 billion gallons annually



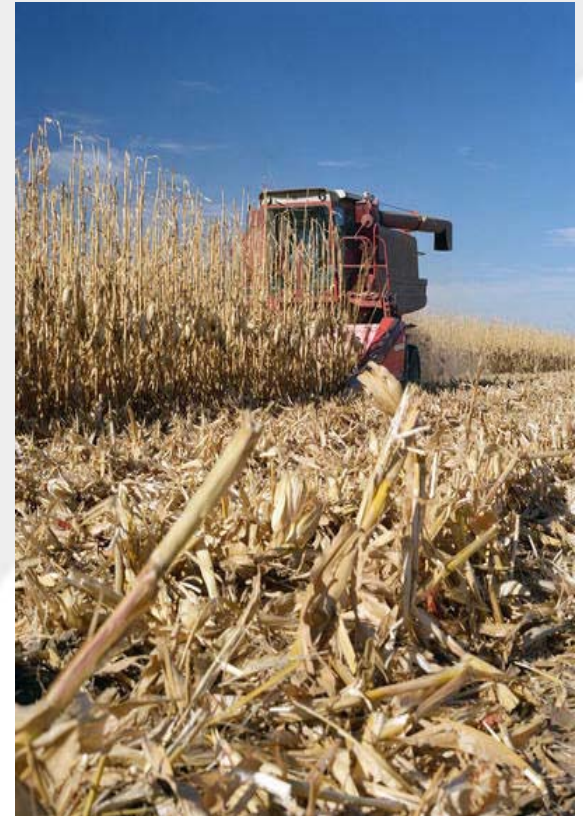
Ethanol: Key Issues

- Energy yield from corn is problematic
- Lot's of environmental impacts from corn plus pollution debate
- Ethanol can be made from other crops
- Can we produce it in CA?



Ethanol Possibilities

- Longer growing season and higher yields in CA
- Feed synergy with dairies
- Novel bioengineered process breaks down plant cellulose like corn stover or switchgrass
- Not yet fully commercial



Summary

- Biofuels can be part of CA's energy solutions
- Biofuels are not zero impact solution
- Production is almost non-existent in CA
- Partnership between environmentalist and agriculture would be powerful alliance
- Need to validate environmental risks and benefits

