Hybridization of Animal Waste and Sewage Treatment Plant with Natural Gas

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Fuel combinations

- Natural gas
  - Animal waste gas
  - Sewage treatment gas
- Diesel
  - Liquified animal waste

Technology combinations

- Reciprocating engine and fuel cell
  - Reciprocating engine as reformer
- Fuel cell and microturbine
  - Fuel cell as precombustion heater
  - Must add heat after compression
- Fuel cell and fuel cell (high temp --> low temp)
  - Solid oxide fuel cell provides heat to PEM for reforming heat
  - Allocate different percent hydrogen distribution to fuel cells

Fuel Hybridization Advantages

- Adding natural gas
  - firms up fuel supply
  - stabilizes energy content
  - dilutes contaminants
  - fuel choice option value

Fuel Hybridization Disadvantages

- Mixes “green” with “non-green”, causing accounting issues
- Perceived unreliability issues of new technology in an industry that prefers proven technology

Barriers

- Current operating procedures do not focus on gas production
- Operator training issues
- Bad track record with animal waste digestors

R&D Needs

- Optimizing productivity by changing operations, paying attention to gas production from digestion- e.g. training of operators.
- Determine the relationship between power produced and what is needed by the plant. Determine issues related to load, peak shaving, etc. Need to capitalize on the potential for base loading. There might be an unusually good potential to base load that doesn't exist in most cases. You might generate more power than you could ever use, so you need to cycle it or export it.

R&D Needs

- Develop non-lagoon digester to avoid storm overflow into water supply.
- Perform a root-cause analysis for why methane capture systems do not last long on farms.
- Assess confined animal feedlot regulations: air, soil, and water emissions regulations.

R&D Needs

- Process issue analysis
- One research need is to assess selective catalytic converters combined with both IC engines and turbines.
- Determine the variance in propane odor and quality, and how to maintain consistency in supply.
- Look at other sources- example, food processing waste.
- Gas cleanup for hybridization use.
- Develop hybrid fuels for power production (see biodiesel discussion above).