Feedstock-Flexible Bioenergy Appliance

Johannes Schwank
Jerry Mader
Transportation Energy Center, TEC
University of Michigan
http://www.engin.umich.edu/research/tec/

Emerging Technology Investment Opportunities:
Cleantech at Michigan

Background on Transportation Energy Cent

Founded in Spring of 2004

20 researchers in our group

plus 7 faculty collaborators and their groups

- Expertise in conversion of liquid fuels and gases
- In the last four years, DoD and DoE have invested over $ 8 million into the Transportation Energy Center.

- This month, start-up of $ 2 million project to develop feedstock-flexible biogas appliance.

Build on expertise in liquid fuel conversion

Diesel, Jet Fuel

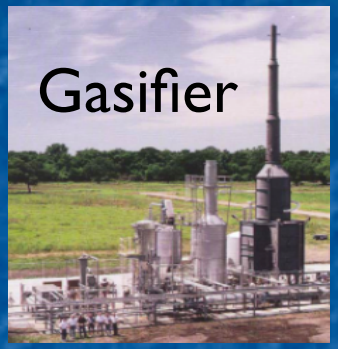
Fuel "Reformer"

Pure "Syngas"

3-10 kW Fue
(SOFC)

Auxiliary Power
on Truck

Biogas appliance concept

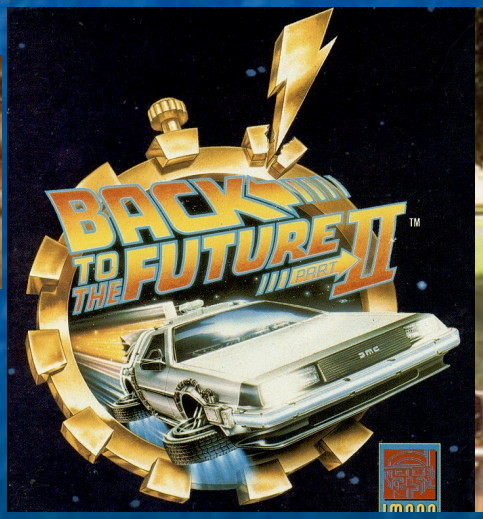


Dirty gas

Biogas Appliance

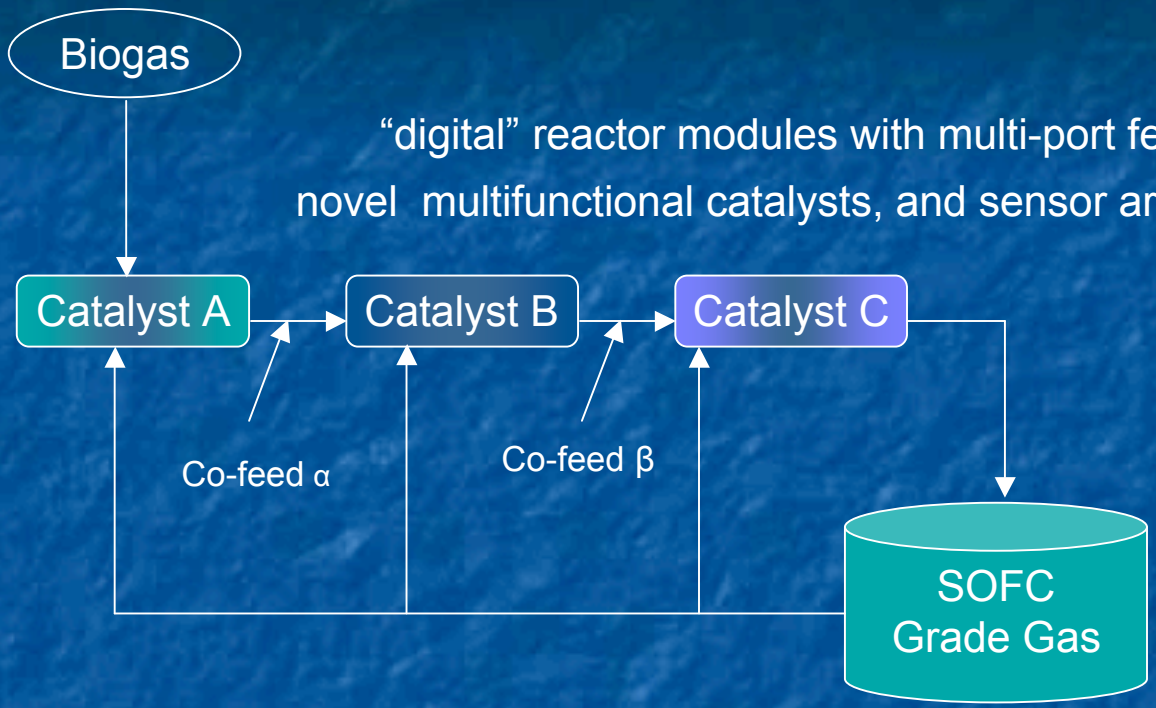
Pure
"Syngas"

Solid Ox
Fuel C



All kinds of biomass

A peek under the hood of the biogas appliance



What is so special about it? How is it innovative?

- Feedstock flexibility
- Portable, scalable
  - Numbering-up of mass-produced, standard modules
- Simplicity of operation
  - appliance on auto-pilot with remote control

What Problem Is Solved?

- America's reliance on imported petroleum
- Underutilization of domestic coal, biomass, and stranded natural gas
- Dependence on centralized large scale energy systems
  - Environmentally unattractive
  - Capital-intensive production and distribution infrastructure
  - Vulnerable to wide-scale disruption
- Untapped potential of distributed energy systems
  - Feedstock flexible biogas appliance enables the utilization of locally available biomass for distributed electricity generation

Impact and Status

What is the impact of the new technology?

- Leverages strength of two largest industries in Michigan
  - manufacturing and agriculture
- Enhanced energy security through stand-alone, distributed microgrids
- Potential to become an export article for Third World

What is the status of the innovation's development?

- Fundamental research completed
- Applied research and prototype development of components initiated
- System integration and pilot-scale demonstration within 2-3 ye
- Business plan being developed this Fall in U of M MBA program

What is the Market?

The smart biogas appliance coupled with solid oxide fuel cells is attractive for:

- Military
  - Generate electricity on demand from locally available resources
- Emergency services, power backup
- Agriculture
  - Supplemental electricity generation from mixed biowastes
- Third World communities
  - Distributed electricity generation where grid infrastructure is unreliable o non-existent
- Utilities
  - Recover and use stranded natural gas in remote locations

Technology Availability

- Prototype of flexible biogas appliance under construction and available for demonstration next year.
- Compact Biomass Gasifier partner being sought.
- Solid Oxide Fuel Cell partner being sought.
- Angel and venture capital funding for start-up company or joint venture slated for 2009.

Who is the contact person?

Jerry Mader, Deputy Director of TEC (jmader@umich.edu, 734 647-7585)