

Mr. Weaver graduated from the University of Maine in mechanical engineering in 1964 and completed two years of advanced study there in chemical engineering and computer control systems in 1967. He has worked as an engineer in the pulp & paper, photographic, metals products, food and wastewater industries. He has won two Maine and a national DOE award for energy innovation. He was nominated for the 2002 and 2003 Platts Global Energy Award for his work in the best pre-commercial technology category. He was one of the principals and founders of SeptiTech Inc. (<http://www.septitech.com>), a company specializing in developing and manufacturing new wastewater treatment technologies. He resigned as VP Engineering at SeptiTech to devote full time to advancing his energy inventions. He volunteers as part of Project Re-Seed to improve middle school hard science education, founded a nationally recognized rural health center, and has been involved in other community projects. Please welcome Lloyd Weaver.....

Biomass Opportunity Focus

Biomass Sources, Emerging Users,
Pathways, Power Economics,
Biomass Progress Issues, Bulk Fuel
Gasification Method

Some Maine Biomass sources

- Trees Maine; 10 MM tons used + 1.4 MM tons residue into pulp
- Switch grass capability, 10 tons+/-acre 100,000 acres should be available in Maine; 1 million tons/yr production capability
- Trash, 2 MM tons, 30% recycle, can perhaps gasify 50% = 1MM tons
- Liquid biomass; Black liquor, Sludge's; human, ag animal wastes

Notes:

- 1 2 million T/Y woody biomass into IGCC power creates 5480 T/D feed, about 450 MW power capability or over \$250 million in merchant wholesale power sales (at 6.5 cents per kWh)
- 2 2 million T/Y biomass into gasification/ethanol production could generate up 228 million gallons ethanol or \$570 million in sales
- 3 Headline 9/9/07: Switchgrass takes root in Virginia, 1000 acres so far; takes 3 years for roots to establish.

Emerging IP Etc.

- IGCC (still has a long ways to go)
- Paper battery breakthrough (a nano technology & a possible mass electricity energy storage)
- Liquid fuels (a new catalysts to make ethanol efficiently is coming).
- Biomass to gas fuels (requires gasification)
- Enhancing the least cost carbon fiber composite material, biomass (there are existing processes)

Pathways

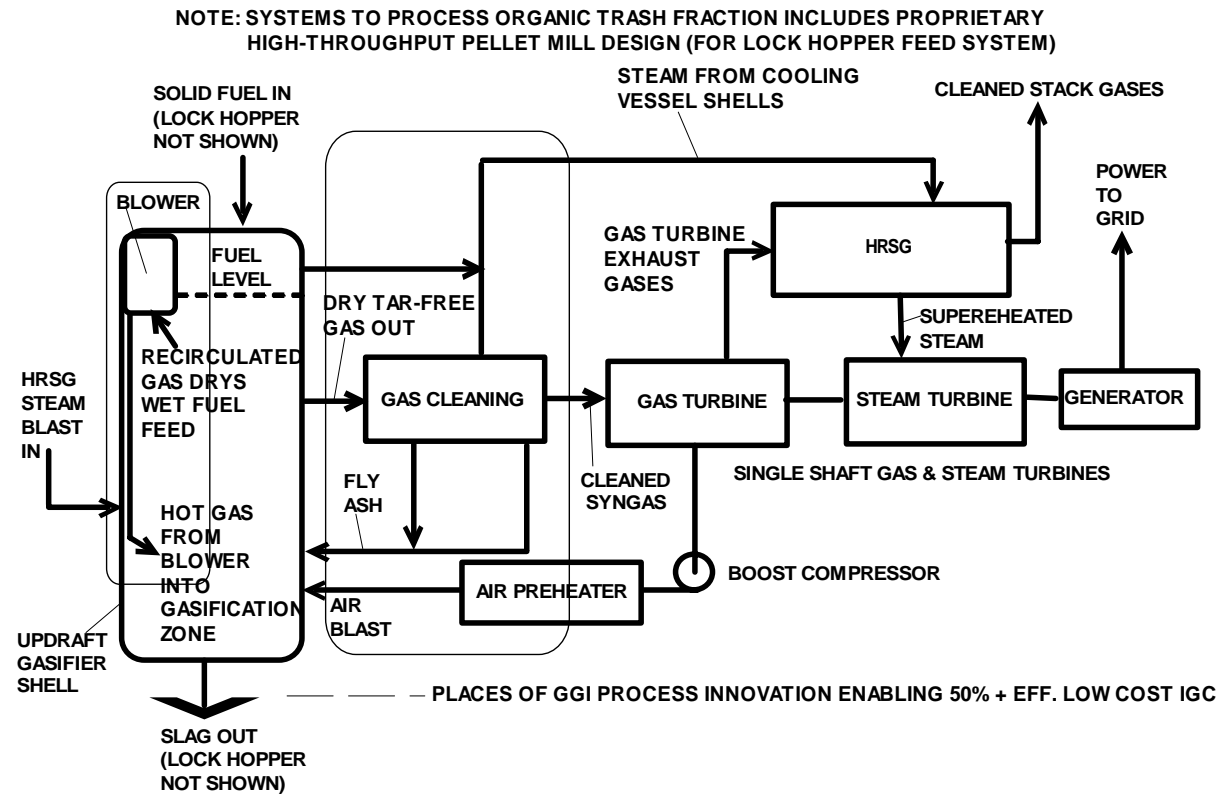
- Develop new technical expertise; ChE petrochemicals, IGCC specialization (usually technical engineering)
- Look at agricultural fibers such as flax, hemp, switchgrass, to make strong composites, example is FlexForm enjoying a a 15% growth rate
- Look at biomass densification needed to process waste materials to feed gasifiers or nano carbon making processes.
- New specialty papers for paper batteries, nano carbon impregnated
- Aggressive project development: forward selling, take advantage of the big tax incentives.
- Energy related
 - Ethanol; gasification, new catalysts exist, 114 gal/ton @ \$2.5/gallon
 - Pellets: wood, switchgrass, OTF of MSW
 - Electricity: IGCC to 50% efficiency (twice wood steam efficiency)

Gasification Power Economics

- Possible 1.9 cents/kWh tax credit
- 5 year depreciation if under 80 MW
- Sell forward at 6+ cents/kWh to finance plants
- There's a green energy premium from buyers
- Kyoto credits (foreign) up to \$30/ton CO₂, \$4 US
- \$35/ton tip fee for organic trash fraction
- IGCC best practice produce 1750 kWh/ton (6000 Btu/lb)

How do you gasify biomass

- Refined gasifier island
- Maximized power eff, 47% small systems, 52% large systems
- Air or O2 blown capability
- No environmental issues



GENERAL GASIFIER INC (GGI) PATENT PENDING,
HOT GAS RECIRCULATION, HIGH-INSULATED GASIFIER SYSTEM, 8/15/07

How do we move forward?

- Fund market research to justify D&D
- Focus on obvious technology gaps: fuel pep, gasification, catalyst development and manufacturing, new composite businesses.
- Got to try it to succeed. Set up a liberal loan guarantee program dedicated to forest products business development
- Enhance UMO' s programs to graduate more engineers and science & math teachers
- Fix middle school science problems to enable far more engineering qualified students.

Handout

1. Why not cellulosic methods to ethanol?
2. Can wood chips be fed directly to gasifiers?
3. What's a bladder dewatering technology like and used for?
4. How are Kyoto credits calculated and who decides this?
5. How long will catalysts last in a fixed bed reactor? How about Regeneration?
6. How clean does the gas have to be for power? For catalytic processes?
7. Does biomass gas have to be O₂ blown to make alcohols or liquid fuels in general?
8. What type of gasifier will work best for pump-able biomass like black liquor?
9. Cost of IGCC systems?
10. How small can IGCC systems get and be economical
11. What are natural fiber composite capabilities? Can they become exterior panels using thermoplastics such as used in making cars and trucks?
12. Can syngas from gasification become a thermoplastic to use with flexible natural fiber materials?