

Cellulosic Ethanol R & D Roadmap

NS Energy R&D Forum 2008

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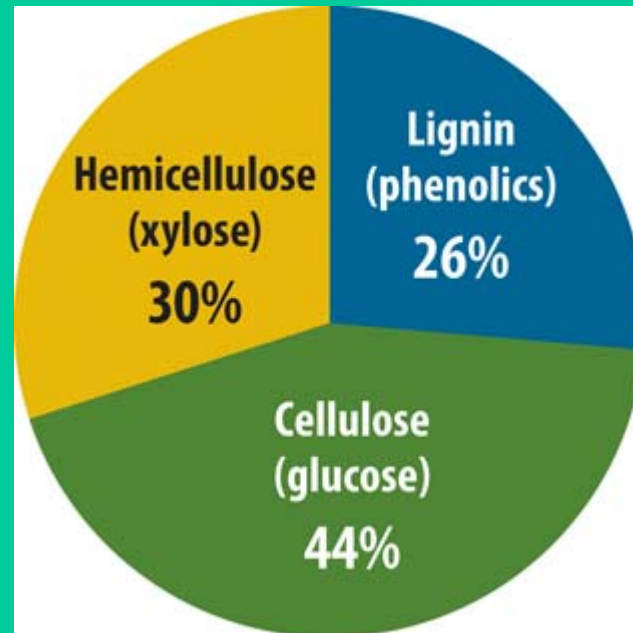
Cellulosic ethanol: A potential for an abundant, secure energy source with environmentally friendly characteristics

Cellulose-based ethanol is derived from the fibrous, generally inedible portions of plant matter (biomass) and offers a renewable, sustainable, and expandable resource to meet the growing demand for transportation fuel.

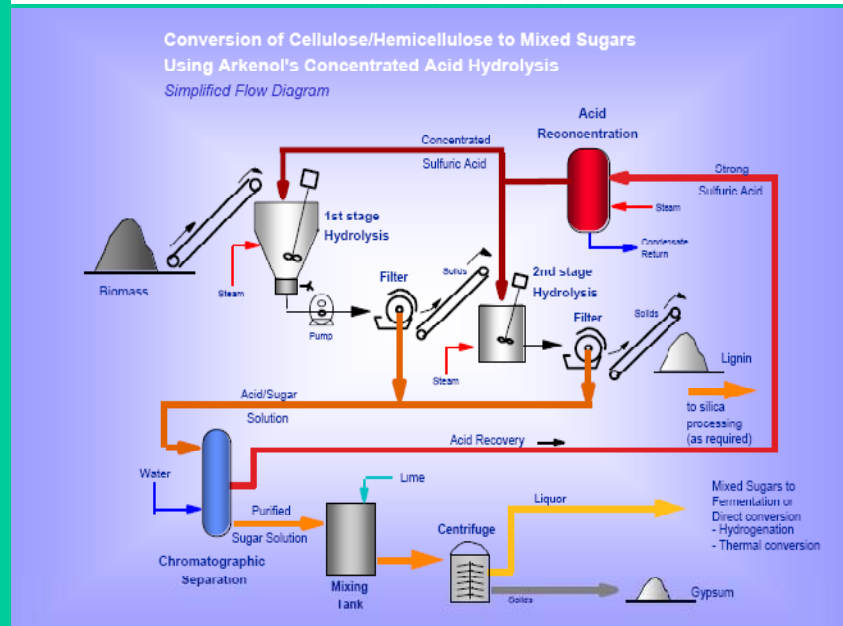
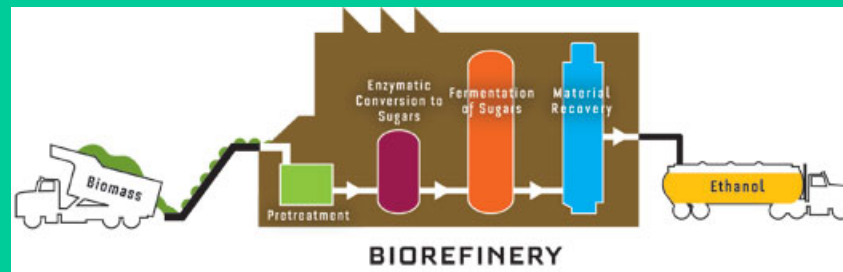
Feedstock options: from straw, corn stover and stalk, urban waste, to switchgrass and bagasse, wood and its residues.

Three main technology platforms target different feedstock segments and each will likely find a commercial avenue due to distinct regional aspects of ethanol production

Typical cellulosic biomass composition breakdown



1. Biochemical technology platform [pretreatment + sugar(s) fermentation]



Technology suppliers:

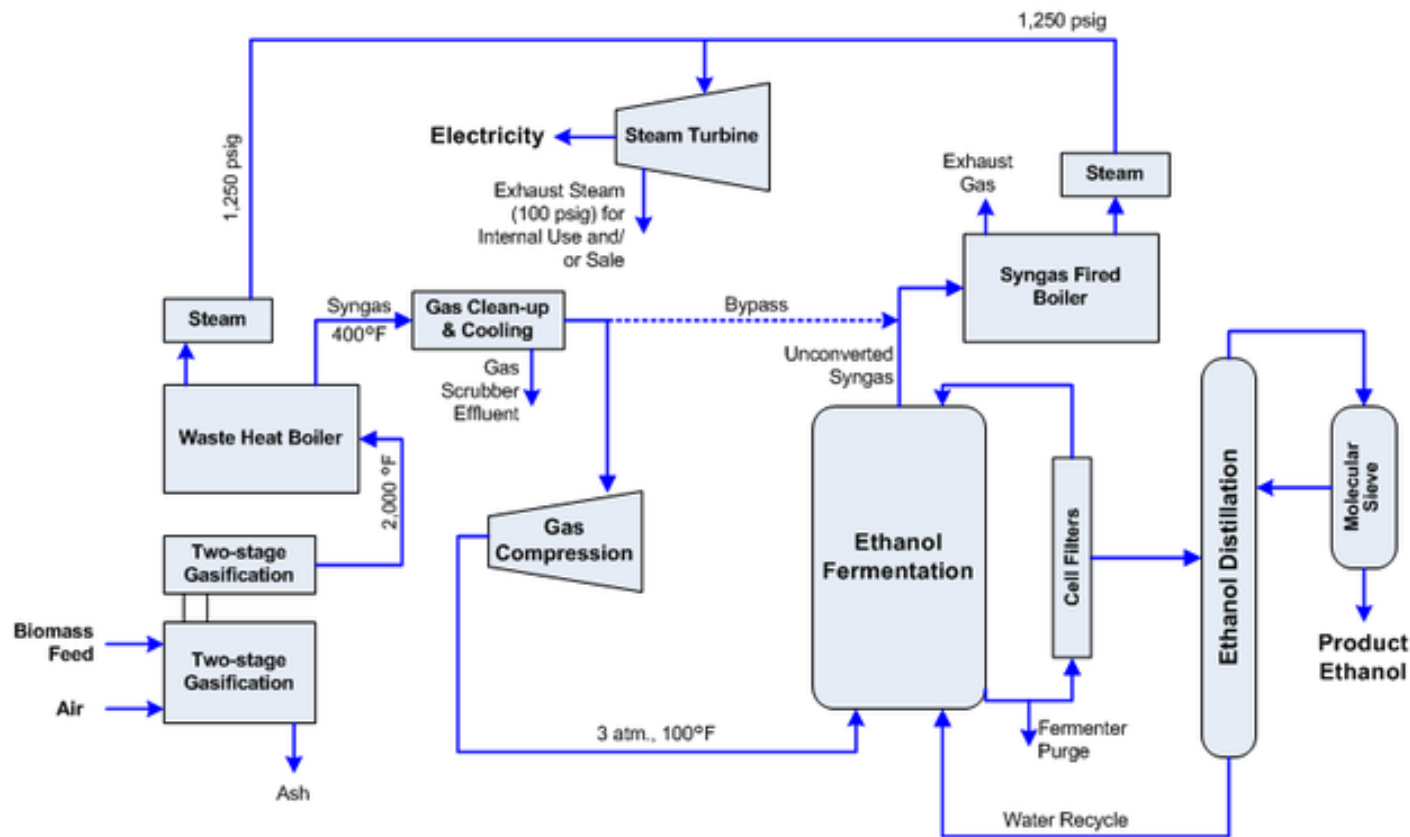
logen
Verenium
Mascoma
Blue Fire/Arkenol
Poet Energy
Abengoa

Feedstock target:

Straw
Corn stover, stalk
Bagasse
Wood chips

2. Thermo + biochemical platform [gasification + fermentation]

BRI Gasification-Biocatalytic Process Schematic



Technology supplier:

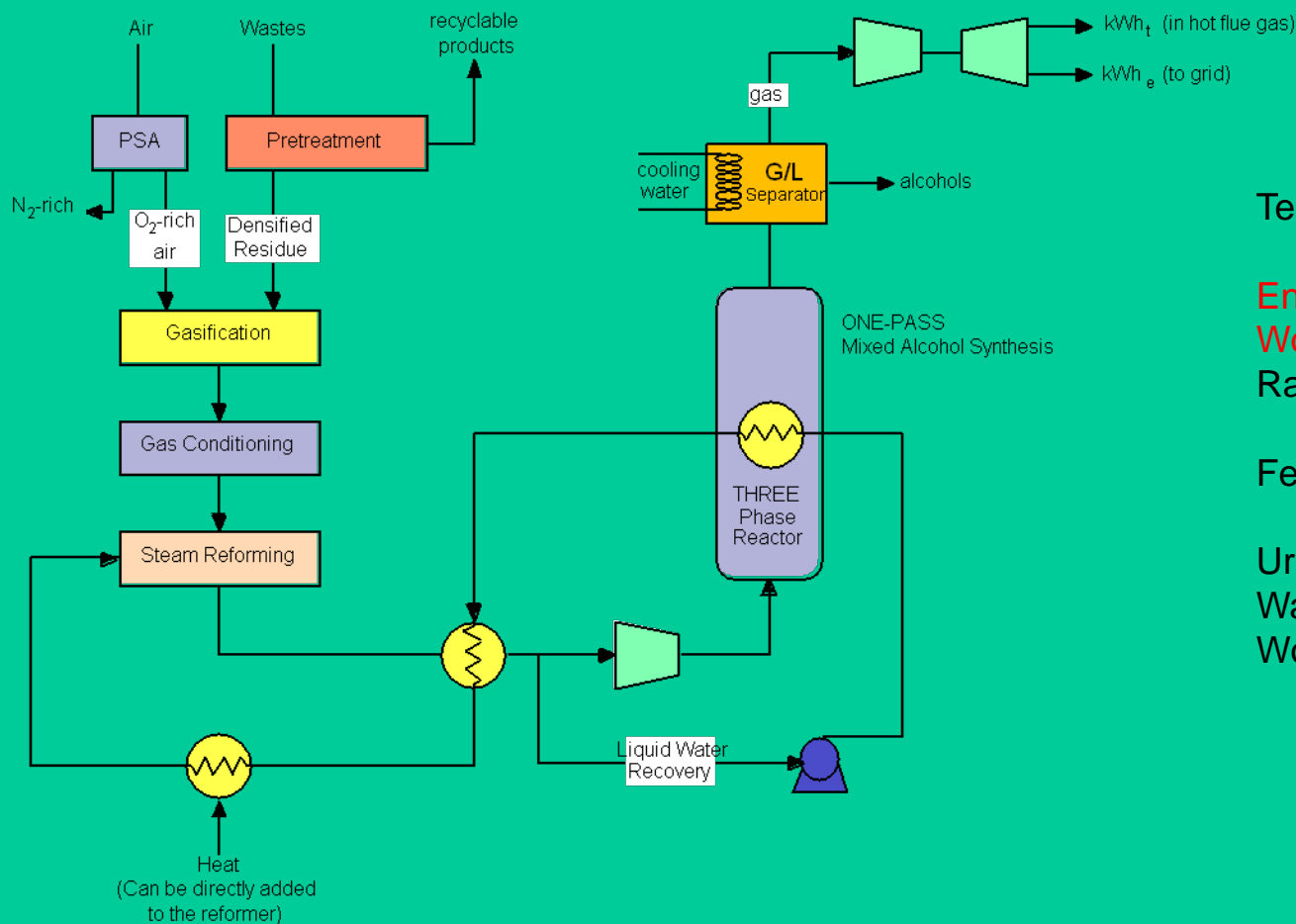
BRI Energy

Feedstock target:

Urban waste
Waste wood
Organic residue

3. Thermochemical platform [gasification + chemical synthesis]

Enerkem's Gas-to-Liquid Technology



Technology suppliers:

Enerkem/Green Field Ethanol
Woodland Biofuels
Range Fuels

Feedstock target:

Urban waste
Waste wood
Wood residues

The key challenges to broad technology deployment and areas of high research interest:

- Resource development (feedstock enhancement, genomics)
- Biomass handling (collection and storage)
- Biomass pretreatment (drying, phase separation, enzymes)
- Biochemical platform: ethanol yield
- Thermochemical platform: gasification and catalytic conversion
- Ethanol recovery and purification
- Integrated plant systems
- Energy and water reduction technology
- Product logistics: transportation and storage

Current Commercial and Demonstration Projects



Fermentation based process:

Mascoma demo plant in Rochester NY; 2009

Verenium demo plant in Louisiana, 2008

Poet Energy commercial plant in SD/Iowa, 2009

BlueFire Ethanol commercial plant in CA, 2009

logen commercial plant in Saskatchewan, 2010 and ID, 2009

Abengoa commercial plant in Kansas, by 2011.

Thermo + fermentation process:

BRI Energy and Alico Inc. commercial plant in FL, 2009

Thermochemical process:

Energem demo plant in Westbury, QC, 2008

Woodland Biofuels planning a demo plant in the Maritimes, 2009

Range Fuels commercial plant in GA, 2009



Thank you