



Northwest
biofuels association

Cellulosic Ethanol
A Northwest Perspective

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CELLULOSIC ETHANOL IN THE NORTHWEST

- ▶ **Problem**
- ▶ **Vision**
- ▶ **Potential**
- ▶ **Challenges**
- ▶ **Outlook**



PROBLEM

- ▶ **Nationwide:**

 - Food vs. fuel collision over agricultural ethanol feedstocks**

- ▶ **Northwest states don't grow corn (or sugar cane)**

- ▶ **Transportation costs may island the Northwest for corn ethanol (as is now the case with petroleum)**

VISION

Cellulosic ethanol as the “Holy Grail”

“New Biofuels Process Promises To Meet
All U.S. Transportation Needs”

Purdue University press release, 3/15/07

Energy balance (energy in vs. energy out)

- Corn ethanol 1 : 1.4
- Cellulosic ethanol 1 : 3-5

For the Northwest

- Abundant biomass → cost-effective petroleum substitute
- Energy independence (from Midwest as well as Middle-East)
- Rural prosperity & economic development
- Pollution reduction

VISION

From an Iogen Promotion

A 50 to 60 million gallon per year cellulosic ethanol Iogen production facility would bring immediate rural economic development to Idaho:

Employment and Economic Benefits

- 100 permanent full-time jobs at the plant facility
- Close to 100 job equivalents for straw assembly (some permanent with trucking)
- 1000 job years equivalent during the 18-24 month construction period
- 450 spin off jobs from plant/assembly operations
- \$25 million annually into the rural economy from the purchase of surplus straw

Additional Benefits

- Keeps jobs on the farms and in the community
- Source of economic diversity for farm economies
- Ethanol is a domestically produced fuel made from renewable resources
- Adds value to raw materials
- Expands rural tax base
- Eliminates need for straw burning

POTENTIAL

Softwood

- Sawmill residuals
- Forest thinnings
(OR, WA, CA, ID = 1, 2, 3, 4 in fire-endangered acres)
- Urban wood (construction waste, land clearing)

***Lots of
Big-Sounding Numbers***

Agricultural Residue

- Wheat & barley straw (Eastern OR & WA, Idaho)
- Grass seed straw (OR Willamette Valley)

Energy Crops

- Hardwood poplar (Potlatch – Boardman, OR)

Municipal Solid Waste & Industrial Waste

POTENTIAL

A fully-developed pulpmill biorefinery industry could be **double or more the size of the current corn-ethanol industry in the United States in terms of annual liquid fuel production. Forest biomass resources are sufficient in the United States to sustainably support such a scale of forest biorefining...**

Princeton University, 2006

CHALLENGE

1. Competitive uses for feedstock

“one person’s waste...”

- **Agricultural residue**
 - needed for soil health
 - growing export market for straw
- **Sawmill residue**
 - competition for heat boilers, cogen for electricity, wood pellets, etc.
- **Forest biomass**
 - direct combustion & anaerobic digestion for electricity

CHALLENGE

2. Technology: cost effective & scalable

Which horse to invest in?

▪ Hydrolysis

Acid/enzyme treatment to separate sugars in cellulose followed by conventional fermentation & distillation

- Concentrated acid hydrolysis
- Dilute acid hydrolysis
- Pretreat, enzymatic hydrolysis
- Fractionation and hydrolysis
- Others

▪ Thermal Conversion

Gasification of cellulose & wastes, followed by Fischer Tropsch catalysis of carbon monoxide/hydrogen syngas

VISION

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End of press release:

“The approach is in the conceptual stages,
and a plan for experimental research is in progress.”

**Reality: technology costs must come down
by an order of magnitude**

CHALLENGE

3. Real World Issues: the business case

Supply, transportation, storage...

- **Guaranteed supply**
 - Plants require 10-15 year supply contracts
- **Collection & delivery costs**
 - Forest land is distant & supply is dispersed
 - Straw must be bailed and transported
- **Storage logistics**
 - Volumes are huge
 - Straw must be kept dry

OUTLOOK

Rising to the challenge

The Northwest is taking action...

- Research and project funding by states
- Entrepreneurial initiatives

Oregon

- 2 grass seed straw projects in Willamette Valley
- Sawmill & forest thinning project in Lane County
- Biorefinery project in eastern Oregon

Idaho

- Barley straw project in S. Idaho (Logan)
- Biorefinery project in Glenn Falls

Washington

- Biorefinery project at Hanford

OUTLOOK

- ▶ It will take **time** (technology development)
- ▶ It will take government **money** (research & project support)
- ▶ Actual cost-effective biomass supply **potential is unknown**
- ▶ We will get there

BUT

- ▶ End product may not be cheap
- ▶ It won't solve our energy needs
- ▶ Efficiency of energy use remains critical



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www.nwbiofuels.org