Highlights to Date

- Separation Technology
- Glycol Production
- Bleached Market Pulp from Seed Alfalfa
- Unbleached Market Pulp from Wheat Straw
- Fluff Pulp
- Feasibility for Columbia County Biorefinery
- Working with Columbia County for location
Separation Technology

- VSEP optimization
- Critical for Pulp mill/Biorefinery
- Condensation of Lignin stream
- Separation of Hemicellulose stream
Glycol Production

- Working with IPCI and VSEP
- Separated Hemicellulose from Wheat Straw Liquor
- Hemicellulose Hydrolyzed to Sugars
- Hydrogenation to Mixed Glycol Stream
Five and Six Carbon Sugar to Glycol Block Flow Diagram

- **Steam (High Pressure)**
- **Steam (Low Pressure)**
- **Hot Waste Water**
- **Cooling Water**

**Monomer Sugars**
- Glucose, Xylose
- Lactose

**Hydrogenation**
- H₂, CO₂, CH₄
- Hydrogen

**Hydrocracking**
- H₂, CO₂, CH₄
- Hydrogen

**Mixed Glycols**

**Separations Distillation**
- Propylene Glycol
- Ethylene Glycol
- Glycerin
- Butanediols
- Alcohols
Production of Seed Alfalfa Market Pulp

- Bleaching Trials with ECF and TCF bleaching
- TCF Optimum Brightness of 68
  - O₂-Q-E-P-P-PAA
- ECF Optimum Brightness of 90
  - D-Eop-D-P
- Produced 50 pounds of 80 brightness
  - D-Eop-P
Market Pulp Production

- Produced 50 Pounds of Wheat Straw Market Pulp
  - 20 pounds of unbleached pulp for prospective customers
  - 20 pounds of semi-bleached pulp for newsprint
  - 10 pounds of ECF bleached pulp for customers
Fluff Production

- Straw Pulp for Fluff Pulp
- Utilization of Wheat, Alfalfa, and other sources
- Developed Alternative Pulping Chemistry
- Increased demand for Fluff Pulp
  - Green Options
  - Customers demanding “Green” Personal Products
Feasibility for Columbia County Biorefinery

- 200 Ton per day pulp mill
- 5 Grades of Pulp to be produced
- 300 Tons per day straw needed
- 10,000 Tons per year Seed Alfalfa
- 30 Tons per day lignin
- 30 tons per day hemicellulose
Feasibility for Columbia County Biorefinery

- Working with Columbia County and Walla Walla County Wheat Farmers for straw availability
- The mill will take all available seed alfalfa straw
- MOU in place for Sugars
- Two customers for lignin
- 60 to 75 jobs created
Possible Site of Mill

- Site outside of Starbuck
- Rail Siding on Property
- Possible Barge Loading Facility across the street
- Close to raw material