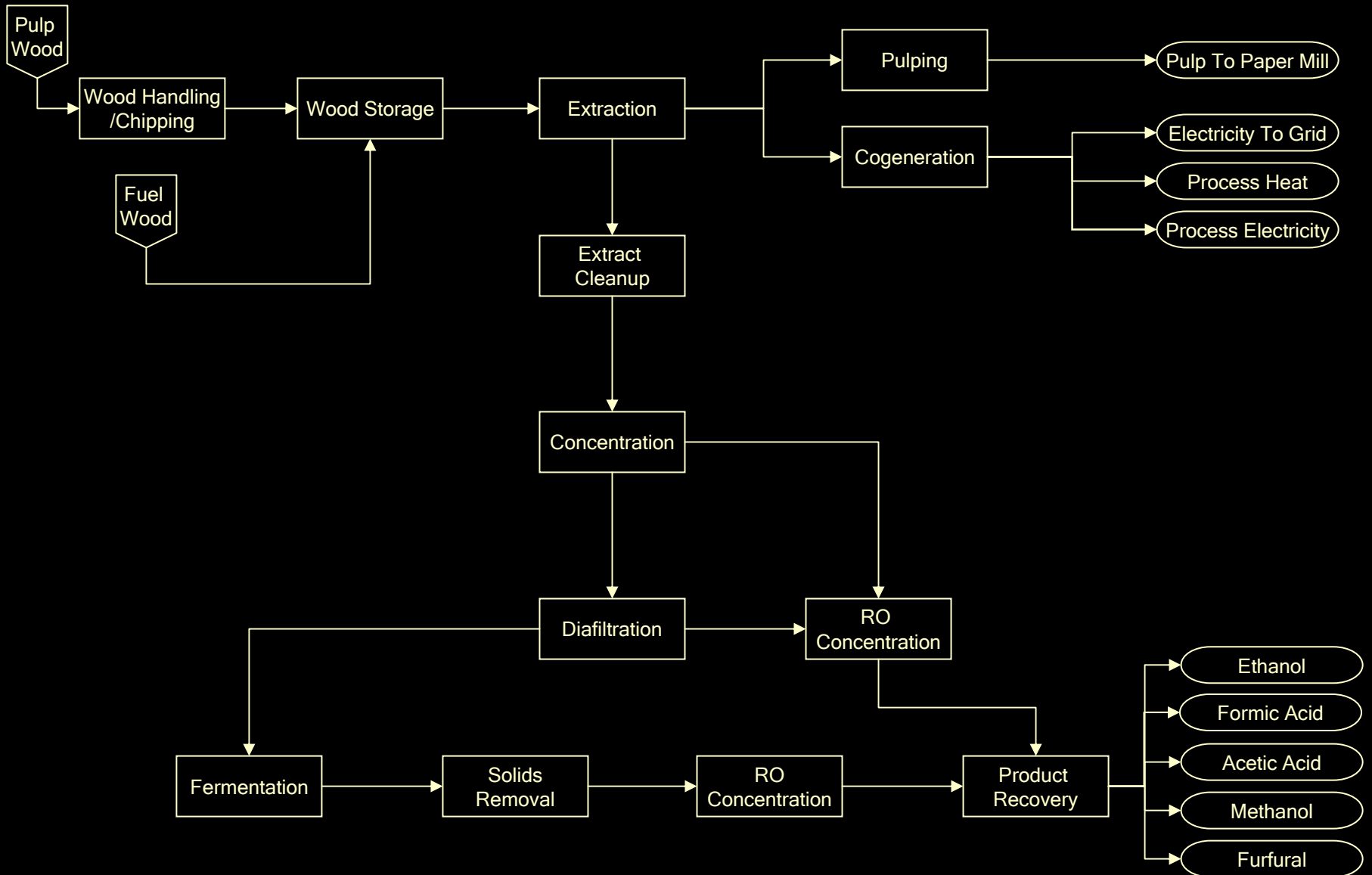


Application Economics From  
the Base Analysis of a  
Forest Biorefinery  
At A 1000 T/Day  
Pulp & Paper Mill

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# Basic Facility Overview



# Major Assumptions

- 350 Operating Days / Year
- Sufficient Recovery Capacity for Incremental Pulp/ We now know that this is certain to be possible - There are choices
- the in energy recovery component
- Sufficient Water Treatment Capacity For Excess Water
- Extraction Conditions for Fuel and Pulp Wood
- Facility In New York

# Major Equipment

- Wood Handling Equipment
- Extraction Equipment - Working with Engineering Firms and  
• Equipment Suppliers to Refine Costs and Scale
- 35 MW Cogeneration Facility
- Membrane Plants - More Knowledge
- Fermentation Capacity Organisms, yield, rate
- Product Recovery - Higher Acetic Acid and Ethanol
- Rail Modifications

# Total Capital Investment

|  |                |
|--|----------------|
| Total Equipment  | \$ 65,973,552  |
| Buildings, Instrumentation, Piping, Electrical Costs   | \$ 69,602,098  |
| Engineering, Construction, Legal, Contractors Expenses | \$ 58,716,461  |
| Contingency  | \$ 24,410,214  |
| Cogeneration Facility                                  | \$ 66,606,000  |
| Total FCI  | \$ 285,308,325 |
| WCI  | \$ 50,348,528  |
| TCI  | \$ 335,656,853 |

# Production \ Operating Costs - Labor may be a bit high and Royalties a bit low

|                                    |               |
|------------------------------------|---------------|
| Wood Costs (Fuel and Pulp)         | \$ 23,940,221 |
| Electrical Costs                   | \$ 3,565,330  |
| Membrane Replacement Costs         | \$ 17,377,463 |
| Labor Costs                        | \$ 4,213,005  |
| Royalties                          | \$ 112,928    |
| Operating and Maintenance Costs    | \$ 18,808,400 |
| Chemicals (Nutrients, Acids, etc.) | \$ 4,003,854  |
| Steam Costs                        | \$ 7,400,038  |
| Contingency                        | \$ 12,497,478 |
| Total Production / Operating Costs | \$ 83,316,517 |

# Revenue

| Product          | Price | Unit         | Production | Unit    | Value/Year       |
|------------------|-------|--------------|------------|---------|------------------|
| Ethanol          | 2.43  | \$/Gal       | 58142      | gal/day | \$49,449,436     |
| Acetic Acid      | 67    | Cents/Lb     | 173510     | Lb/Day  | \$40,688,199     |
| Methanol         | 2.50  | \$/Gal       | 32049      | Lb/Day  | \$4,245,499      |
| Furfural         | 0.84  | \$/lb        | 64725      | Lb/Day  | \$19,029,086     |
| Formic Acid      | 0.35  | \$/Lb        | 9250       | Lb/Day  | \$1,133,169      |
| RO Water         | 2     | Cents/Gallon | 200        | GPM     | \$2,016,000      |
| Lignin           | 30    | cents/Lb.    | 71099      | lb/Day  | \$7,465,369      |
| Incremental Pulp | 550   | \$/Ton       | 188        | T/day   | \$36,253,525     |
| Animal Feed      | 4     | Cents/Lb     | 23.6       | T/day   | \$661,618        |
| Electricity      | 76.27 | \$/MWH       | 30         | MW      | \$19,220,040     |
|                  |       |              |            | Sum     | \$180,161,944.25 |

# Taxes

- Federal Tax Rate: 34%

|   |     |              |
|---|-----|--------------|
| Section 45                                | 1.5 | Cents/ KWH   |
| Section 40.b.2                            | 60  | Cents/Gallon |
| Section 40.b.3                            | 10  | Cents/Gallon |
| NY "Renewable Fuel Production Tax Credit" | 15  | Cents/Gallon |

# Base Case

- Includes Tax Benefits
- All Equity Financing
- Discounted Cash Flow Rate Of Return: 26.3%

# Loan Case

- 35% Equity Financing
- 65% Debt Financing
  - 16 Years
  - 8% Interest
- Includes Tax Benefits
- Discounted Cash Flow Rate Of Return: 56.3 %

# DOE Grant Supported Case

- Includes Tax Benefits
- \$80 Million DOE Grant
  - \$40 Million to TCI
  - \$20 Million Off From Operating Costs, 2 Years
- 65% Debt Financing
- Discounted Cash Flow Rate Of Return: 80.7 %

# Factors Not Included in Analysis

- Heat / Electrical Saving By Mill - Can be quite large
- Flue Gas Drying - For significant energy savings
- Offset Costs Of Incremental Pulp

# Conclusions

- Value To Pulp Mill Is High
- Return on Investment is Acceptable to Excellent
- Product Value Increasing - Number of Products is Increasing
- Good High Risk Investment

# Economics Other Than Pulp Mills

- Use at Combined Heat and Power Plants - Increased Revenue of 50% to 2X
- Use at Pellet Plants - Increased revenue and improved product - Higher BTU/lb
- 300 Dry TPD current focus
- 100 Dry TPD goal
- Hardwood Sawmills and other

Questions ?

# Base Case

DCFROR 26.26%

TCI \$ 335,656,853

WCI \$ 50,348,528

| Year                 | 1                 | 2              | 3              | 4              |
|----------------------|-------------------|----------------|----------------|----------------|
| Revenue              | \$ 180,161,944    | \$ 180,161,944 | \$ 180,161,944 | \$ 180,161,944 |
| Expenses             | \$ 83,238,597     | \$ 83,238,597  | \$ 83,238,597  | \$ 83,238,597  |
| Depreciation (MACRS) | \$ 14,265,416     | \$ 27,104,291  | \$ 24,393,862  | \$ 21,968,741  |
| Gross Profit         | \$ 82,657,931     | \$ 69,819,056  | \$ 72,529,485  | \$ 74,954,606  |
| Taxes                | \$ 7,567,525      | \$ 3,202,307   | \$ 4,123,853   | \$ 4,948,394   |
| NP                   | \$ 75,090,406     | \$ 66,616,749  | \$ 68,405,632  | \$ 70,006,212  |
| A                    | \$ 89,355,822     | \$ 93,721,040  | \$ 92,799,494  | \$ 91,974,953  |
| PWF                  | 0.792015698       | 0.627288866    | 0.496822629    | 0.393491322    |
| PW                   | \$ 70,771,214     | \$ 58,790,165  | \$ 46,104,889  | \$ 36,191,346  |
| Sum PW               | \$ 335,656,853.42 |                |                |                |
| Delta                | \$ 0.00           |                |                |                |

# Equipment Breakdown

|                      |                 |
|----------------------|-----------------|
| Extraction           | \$28,111,802.17 |
| Course Filtration    | \$ 6,986,418.96 |
| Separation           | \$ 6,758,784.50 |
| Fermentation         | \$10,250,762.87 |
| Product Recovery     | \$ 6,526,777.13 |
| Utilities / Recovery | \$ 5,189,579.38 |
| Other Equipment      | \$ 2,149,427.15 |
| Total Equipment      | \$65,973,552.16 |