

Session 5

Bioprocess Evaluation and Confirmation

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This session was organized to include technology improvement and economic evaluation of such improvements, as well as the information and procedures necessary to obtain financing for projects involving novel technology.

The paper presented by D. A. Glassner et al. of the National Renewable Energy Laboratory (NREL) at Golden, CO outlined the process technology and economics for converting biomass to ethanol by the year 2005. Performance requirements were defined, and the process has been modeled on the ASPEN + simulator. Cost estimates were developed for each of the unit operations, and the resulting project economics were presented.

N. D. Hinman et al. of NREL presented the outline of a project proposed for the State of California involving integration of biomass electric power with production of motor fuel grade ethanol from a combination of forest and agricultural wastes. Technical and economic evaluations were presented based on a high degree of integration of feedstocks, fuels, energy (steam and electric power) between an existing biomass power plant and an projected ethanol plant.

Changes in biomass power plant economics, which would reduce profitability, could be compensated for by an ethanol plant utilizing the biomass supply as feedstock for ethanol, with steam and power provided by the existing power plant. Ligneous residue from the ethanol plant could then provide part of the fuel requirements for the power plant.

Specific examples were given for such potential hookups of biomass power plants and biomass-ethanol production facilities. S. Casten and L. R. Lynd of Dartmouth University presented novel approaches to biomass power cycles as alternatives to the conventional Rankine Cycle. Biomass gasification, with gas used either as fuel for steam and power, or for use in a fuel cell.

Integration of such systems with ethanol production can yield higher thermal efficiency. Greenhouse CO₂ benefits are also improved with increased overall energy efficiency.

J. Lee et al. of Biomass Research Team, Korea Institute of Energy Research presented a report on utilization of a 5 ton/d pilot facility for

anaerobic food waste treatment. Successful production of a 70% methane content gas indicated potential for reducing obnoxious products from historic landfill operations to dispose of such food wastes.

The process has advanced to a 15 ton/d commercial operation at Euiwang, Korea, with biogas generated used to heat or cool adjacent buildings.

M. T. Holtzapple et al of Texas A&M University presented a novel approach to production of mixed alcohols (propanol, butanol, pentanol) as fuels from biomass. Conversion of lime-treated biomass through fermentation to carboxylic acids, converted chemically to the respective alcohols.

Economic evaluation indicates potential for production of mixed alcohol fuels from low-grade waste biomass, which could be promising as an alternative to ethanol from biomass. D. J. Gregg and J. N. Saddler of University of British Columbia, with D. R. Cameron and R. Benson of Tembec Inc., P. Q. Temiscaming, and W. H. Cruickshank of Natural Resources Canada, outlined a study for addition of a wood steam pretreatment front end to the Tembec SSL-to-Ethanol Facility. Sugar-containing hydrolyzate from the steam pretreatment would be added to the available SSL to increase ethanol production potential with low-cost feedstocks.

Potential design and operational difficulties were discussed. P. B. Plath and J. B. Keller of the Harris Group, Inc., Denver, CO gave a detailed presentation of Due Diligence requirement of lenders, and the part played by Independent Technical Consultants. These included investigation and evaluation of proposed technologies, risk factors and sensitivity analyses. Confirmation of feedstock availability, cost, and reliability, as well as establishment and reliability of product markets, prices and contracts.

Evaluation of management capabilities, and verification of pro-forma details are essential to assure lenders of the viability of the project, and the capability of the borrower to repay debt (with interest), as well as to maintain profitability.

Other papers relevant to these topics were also presented in the poster session.