Concept for Linking Transformed Forest Biomass as a Fuel Source for Hydrogen Fuel Cells

DRIVING FACTORS FOR USING RENEWABLE RESOURCES AND TECHNOLOGY FROM THE ENERGY SECTOR

- Changing forest health and increased fire risk due to fire suppression since the 1920's, targeted harvesting of species (e.g. Ponderosa pine), insect outbreaks, regulations, and changes in forest policy leading to mill closures.
- Loss of markets and infrastructure to process timber (e.g. mills closing) decreasing the ability to gain economic return from traditional management of forests.
- Traditionally thinned forest material did not have insufficient economic value to pay for its removal, so much of that material was left on the site resulting in higher fire danger.
- Increasing emissions of global greenhouse gases is stimulating a shift from a reliance on fossil fuels for energy towards use of renewable resources that can be sustainably transformed chemically and emits less CO_2 into the atmosphere. Wood biomass has been identified as an important component of the strategy for doubling European renewable energy by 2010. However, the current rate of biomass resource uses is insufficient to reach this goal. This suggests a need to include other biomass materials not currently included in the mix of renewable materials used for energy production.
- Technological breakthroughs in the energy sector (e.g. hydrogen fuel cells) are creating new opportunities to expand the use of renewable resources. Fuel cells represent a means of generating electrical energy virtually free of environmental pollutants.
- The transportation sector has led the development of "CO_2 neutral" transformation practices to convert wood to other useful products (e.g. liquefied wood fuel, fuel oil or renewable motor fuels) and is providing new technological tools to convert renewable resources.

CURRENT APPROACHES TO SUPPLYING ENERGY AND FUEL FROM RENEWABLE RESOURCES

- Conversion of agricultural crops or wastes to produce liquid fuels by fermentation processes (e.g. ethanol). Conversion of agricultural products (e.g. sugar cane, corn) to ethanol for mixing with gasoline has been practiced for some time, and its production has even become institutionalized and commercialized in countries like Brazil.
- Transformation of wood to produce ethanol to replace methyl tert butyl ether (MTBE) as a gasoline oxygenate additive for gasoline because of MTBE's deleterious environmental effects.
- Providing electricity using fuel cell technology where the fuel source for the fuel cells is methanol produced from natural gas. Major developments are occurring here in the automotive and computer based industries.

AN ALTERNATIVE 'BIOMASS-TO-METHANOL AND FUEL CELL SYSTEM' (see below)

- **New efficient and economic processes to transform wood environmentally**. In the past 10 years, wood chemists and engineers have developed new processes to convert wood to methanol that is environmentally sustainable and contributes little to greenhouse gas emissions. This use of transformed wood as a fuel source for hydrogen fuel cells expands the uses of forest materials from mainly as a fuel source in cogeneration plants (e.g. electricity, low-pressure steam production) and for heat/power generation by co-firing with coal or other fossil fuel sources.

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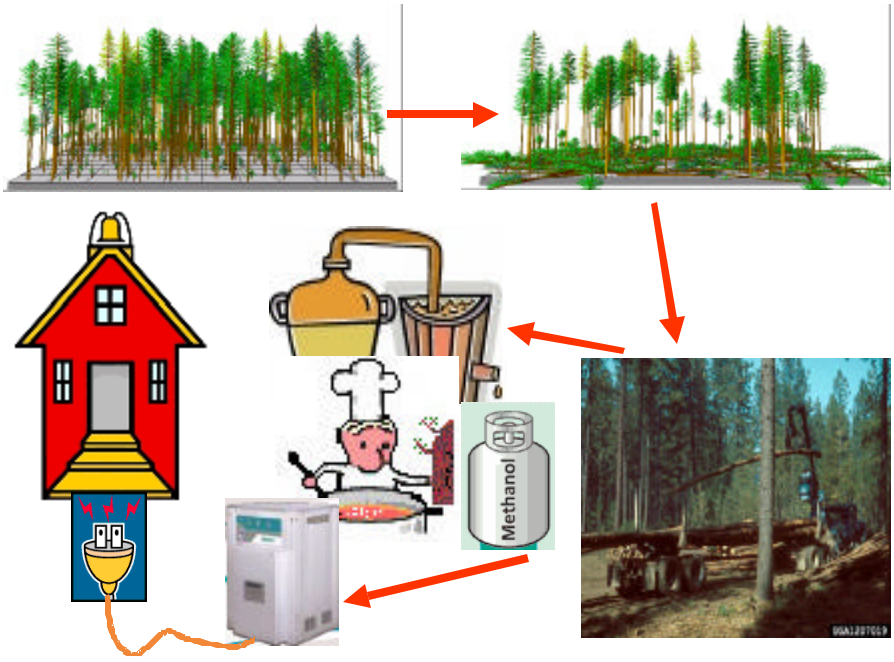
- **Technological developments in hydrogen fuel cells are decreasing their costs and making them safe** . Technological developments in hydrogen fuel cells are allowing fuel cells to use a variety of hydrocarbon compounds and not be dependent on hydrogen gas as its fuel source. These new fuel cells and their fuel sources (wood to methanol) make it possible to decentralize energy production making this system ideal for rural areas.
- **Inclusion of all the environmental and economic externalities to energy production will provide economic return to wood materials that currently have little value** . By including all the real costs (market and non-market) to energy production, materials that used to have high management costs (i.e. thinned forest materials) with little value, would now have positive economic return in the markets. In the past, most wood transformation systems were designed for *large scale processing* of residues from forestry because of economic reasons. Now, small-scale processors have the potential to transform wood materials efficiently and economically when all the externalities in the production phase (e.g., providing environmental services, costs of fighting fires, high unemployment insurance in rural communities, etc.) are included in the total costs.



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