Eco-Link
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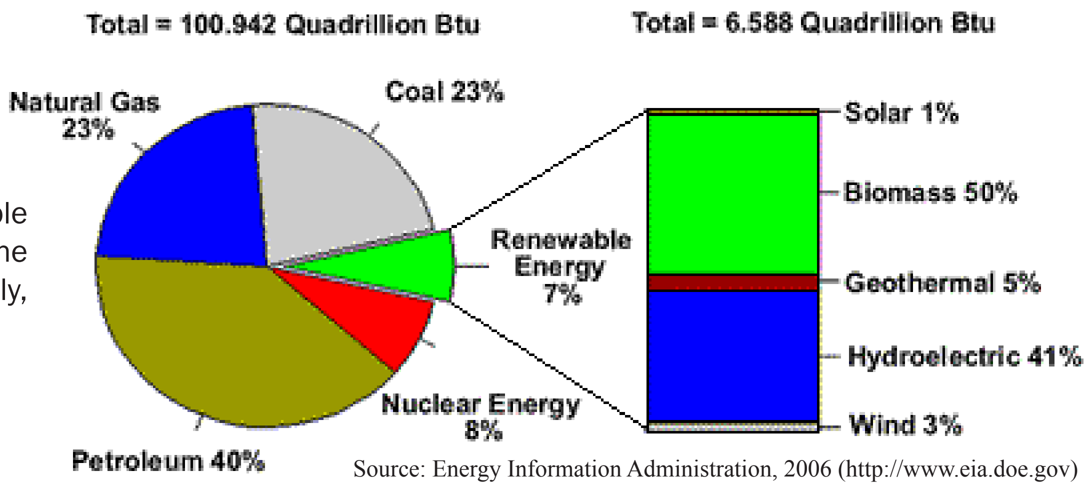
Biomass Energy II

With peak petroleum production now in sight the importance of alternative energy and fuel sources are in the spotlight of discussion. The concept of peak oil as defined by Wikipedia (http://en.wikipedia.org/wiki/Peak_oil) "is the point or timeframe at which the maximum global petroleum production rate is reached, after which the rate of production enters its terminal decline. If global consumption is not mitigated before the peak, the availability of conventional oil will drop and prices will rise, perhaps dramatically." Petroleum industry experts have predicted that the production of oil could peak within one to three decades. Having all of our eggs in one oil basket is a huge economic and environmental risk for our society. Expanding our dependence to other fuel and energy sources is necessary to alleviate our reliance on non renewable fossil fuels.

The Role of Renewable Energy Consumption in the Nation's Energy Supply, 2006:



Source: Energy Information Administration, 2006 (http://www.eia.doe.gov)

One alternative to fossil fuel dependency is the use of biomass converted into energy and fuel. Biomass energy is the use of organic matter - such as wood, plants, residue from agriculture or forestry, and the organic component of municipal and industrial wastes - to provide heat, make fuels, and generate electricity. Wood, the largest source of bioenergy, has been used to provide heat for thousands of years. Up until the industrial revolution when our dependence shifted to fossil fuels, biomass supplied the majority of our energy needs.

In addition to providing a source of heat, biomass can be used, like fossil fuels, to power vehicles and generate electricity. Three leading options for converting large amounts of biomass in North America to energy are production of electricity, production of wood fuel pellets for use in heating homes and schools, and conversion of biomass to liquid fuels. In the United States biomass supplies more than three percent of the total energy consumed, recently exceeding hydroelectric power (Perlack, et al, 2005).

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Why Use Biomass for Energy?

Biomass energy - the use of organic matter for power and fuel - offers not only an alternative to dependency on non-renewable resources such as fossil fuels, but also offers benefits in the form of environmentally sound energy, a potential for rural economic growth, and national energy security benefits. In western regions of North America, the use of significant quantities of woody biomass also offers a solution to the problem of excess biomass (see below). Consider the following:

- As a renewable energy source, biomass energy produces fewer emissions than conventional sources and can actually improve environmental quality by offsetting fossil fuel use and related emissions and by using wastes that are creating land use problems.
- Biomass energy growth can create new markets and employment for farmers and forest workers, many of whom currently face economic hardship. It can establish new processing, distribution, and service industries in rural communities.
- Wood from sustainably managed forests can be replenished continuously, leading to a dependable and renewable supply.
- Because trees store carbon as a result of photosynthesis, there is no net production of carbon dioxide (CO_2), the major greenhouse gas from wood combustion, as long as the volume of trees harvested is replaced by new growth. In a sustainably managed forest, the CO_2 generated during combustion of the wood equals the CO_2 sequestered from the atmosphere during the lifecycle of the tree.
- Wood fuel contains very small amounts of sulfur and heavy metals. The sulfur and nitrogen in wood, yields SO_2 and NO_X in the combustion process. However, the rate of emissions is significantly lower than that of coal-based generation and do not pose a threat to acid rain pollution.
- Utilizing woody biomass as energy has the potential to help restore forest health through practices such as active thinning and slash removal to decrease fire risk (see below).

Fire and Forest Health

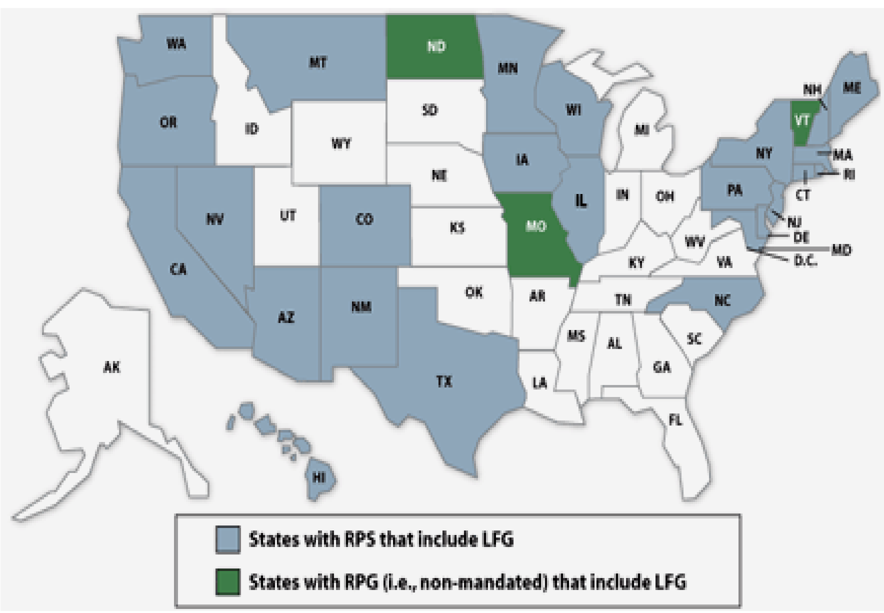
Fire has historically shaped millions of acres of forest in North America. Native Americans used fire to manage their landscape long before European settlement. Fire was used to fell trees, encourage wild seed production, and to create favorable habitat conditions for wild game animals, to name a few. Intentional burning stopped with the arrival of settlers. The result was increased survival of young seedlings and an increase in forest litter across the landscape. Over time, as ever greater numbers of trees had to compete for resources, large numbers of them became unhealthy and prone to attack from insects and disease. Aggressive forest fire suppression beginning in the late 1930s served to further increase tree survival as well as accumulation of combustible material. The problem has been accentuated in recent years by sharp reductions in harvest rates from federal forests. Given the increase in dead woody debris present, both in larger landscape patches and in the vertical structure of the forest, any ignition in dry weather, such as in the past few years, tended to result in catastrophic wildfires that behaved so violently that suppression was nearly impossible. More fires of this kind are likely in the years ahead.

After the wildfire season of 2000, President Clinton requested development of a national strategy for preventing the loss of life, natural resources, private property, and livelihoods in the wildland/urban interface. Working with Congress, the Secretaries of Agriculture and Interior jointly developed the National Fire Plan (NFP). One of the five key points of the plan was reduction of hazardous fuels.

There are many options for dealing with excess forest fuels: prescribed burning, thinning, and increased levels of harvesting to name a few. Environmental, economic, and social considerations will dictate how we ultimately deal with biomass. A key consideration, however, is bioenergy. Incorporating bioenergy development into forest fuel reduction strategies furthers complete resource utilization for the benefit of producers, society at large, and the environment.

The use of biomass for energy and fuels has much potential but it is not without challenges and/or constraints:

- Economic constraints such as the cost of transportation to processing mills. First, to make biomass fuel delivery feasible, forest managers must have a viable market within reasonable distance that pays an adequate price. Second, to assure payback of large initial investments, investors in energy production facilities must have a reliable fuel source at prices that allow competitive production over a long enough period of time.
- Environmental constraints such as potential impacts on soil and water and loss of habitat diversity associated with removal of downed woody debris.
- Accessibility constraints such as steep slopes, unroaded areas, and environmentally sensitive areas.
- Care is needed to make sure that subsidies and other governmental incentives do not place established wood-using industries at a competitive disadvantage in North American and world markets.
- The use of subsidies to encourage use of biomass could result in nonsensical practices. For instance, it is possible that the net energy it takes to move woody biomass to a processing facility could exceed actual biomass energy outputs.
- Use of lands for energy production, such as for establishment of energy crops on agricultural land, cannot be allowed to impair our long-term ability to produce food.



Source: www.epa.gov/lmop/res/guide/state_rps.htm (2007)

Renewable Portfolio Standards

Renewable portfolio standards (RPS) are state policies which require a certain percentage of energy to be from renewable sources (e.g. wind, solar, biomass, geothermal), including landfill gas (LFG), by a given date. For example, Arizona's RPS requires that 15 per cent of power sold by their electric utilities be from renewable resources by 2025. Twenty-four states and British Columbia have set similar standards. Maine set and reached the highest RPS goal in the U.S. with 30 per cent of its electricity utilities produced from renewable resources.

The wood products industry is by far the leading producer of bio-energy in the United States. Using as fuel the bark, sawdust, and trim from logs used to produce lumber and other products, energy is generated to heat buildings, run machinery, and produce electricity. For example, biomass fuel (including black liquor that results from chemical pulping of wood) is often burned in a boiler to produce high-pressure steam. The steam can be introduced into a steam turbine where it flows over a series of aerodynamic turbine blades, causing the turbine to rotate. The turbine is connected to an electric generator, so as the steam flow causes the turbine to rotate the electric generator turns, generating electricity. Today the North American forest products industry is 50-65 per cent energy self-sufficient due to energy production from biomass.

Biomass for Fuel

Source: U.S. Department of Energy, National Renewable Energy Department

Biomass can be converted directly into liquid fuels like ethanol and biodiesel to supply transportation needs. Ethanol, an alcohol, is made by fermenting any biomass high in carbohydrates, like corn, through a process similar to brewing beer. Developing technologies will allow the production of ethanol from wood and other forms of biomass, either through the use of enzymes or high levels of heat as a first step in the conversion process.

Ethanol has two-thirds of the energy of the same quantity of gasoline, and can be mixed with gasoline for use as a transportation fuel. A benefit of incorporating ethanol into gasoline is that it reduces a vehicle's carbon monoxide and other smog-causing emissions.

Biodiesel, an ester, is made using vegetable oils, animal fats, algae, or even recycled cooking greases. It can be used as a diesel additive to reduce vehicle emissions or in its pure form to fuel a vehicle. As with ethanol, it will eventually be possible to produce biodiesel from wood and other forms of biomass.

Glossary of Terms

Biomass
Organic matter such as wood, plants, residue from agriculture or forestry, and the organic component of municipal and industrial waste.

Black liquor
Spent liquor from the pulping process which can be recovered to be reconstituted into cooking chemicals.

Energy Policy Act of 2005
The act provides tax incentives and guaranteed loans for energy production to assist with growing energy problems. The act promotes the use of renewable energy sources and credits for wind, solar, and biomass energy.

Forest Health
Forest health is defined by the US Forest Service as: a condition wherein a forest has the capacity across the landscape for renewal, for recovery from a wide range of disturbances, and for retention of its ecological resiliency while meeting current and future needs of people for desired levels of values, uses, products, and services.

Public Utility Regulatory Policies Act of 1978 (PURPA)
A US federal law enacted in 1978 which was intended to encourage more energy-efficient and environmentally friendly commercial energy production. PURPA defined a new class of energy producer called a qualifying facility. QFs are either small-scale producers of commercial energy who normally self-generate energy for their own needs but may have occasional or frequent surplus energy, or incidental producers who happen to generate usable electric energy as a by-product of other activities. When a facility of this type meets the Federal Energy Regulatory Commission's requirements for ownership, size and efficiency, utility companies are obliged to purchase energy from these facilities based on a pricing structure referred to as avoided cost rates. These rates tend to be highly favorable to the producer, and are intended to encourage more production of this type of energy as a means of reducing emissions and dependence on other sources of energy.

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Sources

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