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USING WOOD TO PRODUCE ENERGY FOR U.S. HOMES AND BUSINESSES

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Wood is one of the most abundant and versatile renewable energy sources in the United States. Heat and electricity can be generated from low-value woody material such as small trees, tree limbs, brush, and wood waste at scales from residential to industrial. Using wood to generate energy can lead to local employment, reduce energy expenses for buildings, companies, and local communities, reduce wildfire and insect hazard for forests, and reduce smoke pollution from open burning of forest residues. Here, we illustrate some opportunities for wood energy production as well as key considerations for creating successful projects.

Generating energy from wood

Woody biomass is a versatile commercially viable energy source, producing:

- heat or cooling,
- electricity, or
- both, simultaneously.

Wood biomass is converted to energy:

- in specifically-designed wood-fired energy facilities, or
- it is potentially burned along with coal in existing coal-fired power plants.



Facility locations and energy use

Stand-alone electricity generating stations produce energy used:

- in the electricity grid serving homes and businesses.

Facilities at industrial sites typically produce both heat and power used:

- for on-site electrical and heating needs,
- in the electricity grid serving homes and businesses, and
- to dry wood or in food production processes.

At schools, hospitals, and government buildings, smaller scale facilities produce energy for:

- heating or cooling one or more buildings,
- generating hot water for use on site, and
- steam production.

At homes, especially in cold northern regions, wood energy is used for:

- home heating.



Sources of wood used for energy production

Forest wood material for energy comes from:

- small trees harvested to manage overly dense forests,
- wood waste that is left over from timber harvesting activities, or
- fast growing trees grown specifically for use in wood energy production.

Other sources of wood for producing energy include:

- wood residues created in the manufacturing of wood products,
- trees, tree trimmings, and brush removed in urban forest management, and
- wood left over from building construction and other wood waste.



Value-added energy products from forest wood

For use in wood energy production, forest wood is converted into:

- firewood, commonly used in home heating,
- chipped or ground wood from tree limbs and small trees,
- wood pellets, increasingly popular for use in wood boilers in the U.S. and Europe, and
- specialty wood fuels, such as bio-oil and torrefied wood that are being developed.

Benefits of wood energy

The potential benefits from using wood to produce energy include:

- reducing greenhouse gases by offsetting fossil fuel use,
- reducing air pollution from otherwise disposing of woody debris by open burning,
- creating local jobs and economic activity from facility construction and operation,
- retaining energy expenditures in local communities,
- reducing wildfire severity, restoring forest health, and improving forest watersheds,
- partially offsetting the costs of forest treatments, and
- contributing to local pride as local resources are used for the generation of locally-needed energy.

Considerations for successful implementation of wood energy projects

- Early and frequent engagement with the public to address questions around the siting and supplying of wood energy facilities can help address any concerns about social and ecological implications of bioenergy production.
- Using emissions controls can help mitigate the effects of fine particulates and other emissions from wood energy production.
- Local economic activity associated with wood energy can be increased by promoting use of local contractors and suppliers.
- Communicating the existence of best management practices can help address the ecological issues that can arise from using forest wood to produce energy.
- Using wood biomass projects to address forest restoration needs, working collaboratively, and building on initial successes can help address public concerns about wood energy projects.

Implementation Stories

Biomass heating for County facilities in Rockingham County, New Hampshire

Rockingham County in New Hampshire replaced an aging oil burning boiler with a biomass boiler system to achieve greater energy production at lower cost. The biomass heating system provides steam for heat, hot water, laundry, and kitchen facilities in the county's long-term care facility and the county jail. The new biomass facility uses about 4,000 tons of woodchips per year purchased from local producers at a cost of about \$225,000. In addition to providing reliable and efficient thermal energy, the project has resulted in reduction in energy costs to the local community of about \$336,000 per year, a net reduction in fossil fuel emissions of about 2,500 CO₂e metric tons annually, and the availability of biomass ash for use as a soil amendment by local farmers. The project was funded in part from a USDA Forest Service Woody Biomass Utilization Grant and American Recovery and Reinvestment Act Funds.



Modular biomass facility provides heat to the local hospital in rural Burns, Oregon

Not all biomass energy facilities need to be large. The Harney County Hospital uses a small modular unit—fitting into just four parking spaces—to produce heat and hot water for the hospital. Installation of the unit was completed in two days at a cost of \$269,000. The small wood pellets used to power the unit are purchased from an Oregon wood pellet producer at a cost of about \$10,000 per year. Pellets are delivered twice a year and stored on-site in a small hopper located alongside the biomass boiler. The project was funded through loans; additional financial assistance was provided by an \$80,000 state tax incentive. Installation costs for the unit were expected to be offset by energy cost

savings within just three years. Savings from using woody biomass, rather than propane, has allowed the hospital to invest in a new MRI scanner. The almost fully-automated system requires very little staffing and the leftover pellet ash is used as soil amendments in the local community.



Biomass facility in Gypsum, Colorado produces heat and electricity from beetle-killed timber

The Eagle Valley Clean Energy facility began initial production in December 2013 and produces electricity that is purchased by the local electric cooperative. At full production, the facility produces enough electricity to power nearly 10,000 homes and helps the electric cooperative meet the 20% renewable energy target mandated by Colorado. Biomass to run the facility will mostly come from forest restoration efforts completed on nearby USDA Forest Service lands. Forest restoration efforts will remove trees killed by bark beetles that could otherwise increase the severity of wildfires. Without the demand for use in bioenergy production, the trees would have little value and their removal would be more costly. Completion of the biomass facility project was more feasible because of the assurance of a steady supply of biomass feedstock through a 10-year stewardship contract between the U.S. Forest Service and a Colorado forest restoration company. The USDA Rural Utilities Service provided a loan for partial construction of the bioenergy facility; a Woody Biomass Utilization Grant from the USDA Forest Service helped finance facility design. Construction of the facility was estimated to have supported 107 jobs; ongoing operations are expected to support 42 jobs.



More information

Additional project information and publications are available at:

<http://fhm.fs.fed.us/science-technology/energy-forest-products/wood-innovation>

and:

<http://ewp.uoregon.edu/>

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