

# FEMP

## Federal Energy Management Program

### Biomass and Alternative Methane Fuels (BAMF) Super ESPC Program Fact Sheet

Leading by example,  
saving energy and  
taxpayer dollars in  
federal facilities

## Biomass Energy — Focus on Wood Waste

Abundant sources of wood waste in many areas can supply federal facilities with clean, renewable, low-cost fuels and enhance their energy security.

### Industry Snapshot

Biomass—renewable organic material such as wood and agricultural residues—comprises the oldest and most prevalent energy resource. Even today, biomass is the world's

Thousands of large and small U.S. power plants use biomass fuels to produce more than 7700 MW of electricity.

Wood waste is one of the most abundant, cost-competitive, and environmentally friendly biomass resources. Currently the most cost-effective wood sources are residues from manufacturing and wood waste otherwise destined for landfills. Manufacturers generate an enormous amount of waste residue in the process of making products such as lumber, furniture, pallets, and paper. In general, less than 50 percent of the tree ends up in a final product, and the balance represents a vast underutilized resource.



By-products from logging operations, wood residues from manufacturing, and clean, burnable solid wastes that would otherwise go to landfills are all sources of low-cost wood-waste fuels. In contrast to fossil fuels, the combustion of wood fuels adds no new CO<sub>2</sub> to the atmosphere.

most popular fuel for heating. With rising fossil fuel prices and growing environmental concerns, biomass energy systems are reclaiming their positions in schools, factories, military bases, and community energy plants. Biomass recently surpassed hydropower as the nation's leading source of renewable energy and now accounts for more than half of all renewable energy used in the United States. Energy plants that use wood waste to produce heat and electricity make by far the greatest contribution to the total.

### Benefits of Using Wood-Waste Fuels for Federal Facilities

- Stabilizes energy costs and protects facility from volatility of gas and electricity prices.
- Enhances energy security—reduces vulnerability to power grid interruptions.
- Environmental benefits—lower NO<sub>x</sub> and SO<sub>x</sub> emissions and no net increase in CO<sub>2</sub> emissions.
- Diverts material from landfills and avoids disposal costs.
- Progress toward federal goals for use of renewable energy.



U.S. Department of Energy

### Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy  
is clean, abundant, reliable, and affordable

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Wood fuels can be cheaper than coal (dollars per Btu), and always emit less air pollution. Because the cost of disposal is avoided in some cases, wood waste may have a negative price. Energy projects using the abundant wood waste found on many federal lands can not only displace the use of fossil fuels but also reduce the risk of forest fires.

## Applications

Given the age of the industry, it is not surprising that the technologies for converting wood to energy are well established. Whether for space heat, process heat, or electricity production, no other type of fuel has been used successfully in more types of system designs. In most industrial wood-to-energy applications, steam is produced in a boiler using standard stoker technology or newer



The BAMF Program can provide any federal facility with a free report on the sources of wood waste near the facility.

fluidized-bed combustion technology. Energy is generated this way in thousands of settings around the world using conventional, off-the-shelf equipment. The systems can be designed to produce heat, electricity, or both in combined heat and power systems. Wood-biomass systems produce

**To encourage agencies to displace the use of fossil fuels with renewables**, and to reduce the risk of forest fires, the Secretaries of Agriculture, Energy, and the Interior on June 19, 2003, executed a joint MOU that promoted the use of woody biomass from federal property as a source of fuel for renewable energy projects.

## The BAMF Super ESPC

Federal agencies can use energy savings performance contracts (ESPCs) to finance their energy projects, allowing government facilities to reduce their energy use and costs without depending on Congressional appropriations to fund the improvements.

Federal facilities worldwide can use the Technology-Specific Biomass and Alternative Methane Fuels (BAMF) Super ESPC, which offers financing and private-sector expertise specifically geared to using renewable BAMF resources.

electricity in units ranging in size from 5 kilowatts to 75 megawatts.

Another viable application for wood waste as a fuel is in the co-firing of conventional coal-fired boilers, which means using biomass as a supplementary energy source in high-efficiency boilers. Retrofitting most existing systems for co-firing requires relatively minor modifications and can significantly decrease emissions of sulfur dioxide and nitrogen oxide. Also, new developments such as gasification technologies offer dramatic improvements in process efficiency and could have a significant impact on the industry.

## Potential for Wood-Waste Projects in Federal Facilities

The National Energy Technology Laboratory completed a resource assessment for FEMP to determine the potential for wood-waste projects at federal facilities. The assessment analyzed data reported by the wood products industry and indicates abundant opportunities for using this resource:

- There are more than 12,000 sources of wood residues in the United States.
- There is at least one substantial source of wood waste from manufacturing within 50 miles of virtually every federal facility.
- For 75 percent of the larger federal facilities, there are 10 or more sources within 50 miles.
- There are more than 4700 high-volume wood-waste sources within 50 miles of federal facilities.



A storage silo and part of the feed system for the wood-chip-fired cogeneration plant that powers a Maryland correctional facility. The plant provides security from power interruptions and cuts fuel cost by 63 percent.

## Examples of Successful Wood-Waste-to-Energy Applications

### Wood-Fired Cogeneration Provides Reliable Off-Grid Power for Maryland Correctional Facility

A Maryland Department of Corrections facility has cut its fuel costs by 63 percent by producing its own power using a wood-chip-fired cogeneration plant. For this facility, on the eastern shore near the town of Westover, the decision to depend on a wood-fired power plant was driven predominantly by issues of energy security. The rural area surrounding the prison is isolated from the normal energy supply infrastructure. There are no natural gas pipelines or direct road or rail links. Since power interruptions cannot be tolerated at a prison, having a dedicated power system at this site was deemed a necessity.

The power plant consists of two boilers that provide steam to two condensing steam turbines rated at 1.9 MW each. The boilers are fueled by 50,000 tons of green wood chips per year that are acquired under a 5-year contract.

The system was originally designed to supply all of the electrical power, heat, and hot water needed for a 1500-bed facility, and to have enough surplus capacity to return as much as 1 MW of electricity to the power grid. However, the facility was expanded to 3100 beds, resulting in a 60

percent increase in energy demand. The original system continues to service the expanded facility with reliable, low-cost energy.

### Central Michigan University Retrofit to Wood-Fired Energy Has Four-Year Payback

The wood-fired energy system at the Mount Pleasant Campus of Central Michigan University (CMU) was built in 1984 as a retrofit to an existing natural-gas-fired system at a total cost of \$3.6 million with a payback period of less than 4 years. The conversion included the addition of a solid-fuels gasifying burner and a boiler rated for 50,000 lb per hour of steam. A 1-MW steam turbine generator provides electrical power and serves as a pressure-reducing valve for steam that is used downstream for heat, air conditioning, and hot water.



The nation's leading source of renewable energy is now biomass—predominantly wood waste, such as the wood-chip fuel being unloaded in the photo above.

The CMU system is designed to burn 43,700 tons of whole-tree chips per year. The chips are harvested from low-grade wood supplies within a 50-mile radius of the campus. CMU estimates that the school is saving more than \$1 million per year through reduced fuel costs while injecting approximately \$1 million per year into the local and state economy from wood harvesting and processing operations.

### Vermont Public Schools Use State-of-the-Art Wood-Fired Systems

Vermont is a national leader in wood-to-energy applications and has been particularly successful in heating its schools with wood. Over the past 15 years, wood-fired heating systems have been used in as many as 25 Vermont schools ranging in size from 23,000 to 270,000 square feet. These facilities use about 8000 tons of wood chips per year



and reduce fuel bills by more than 50 percent compared to the cost of fuel oil. The systems are modern, computer-controlled facilities with automated fuel feeders and high-efficiency boilers that have very low emissions.

One Vermont school that has discovered the advantages of wood heat is the Hazen Union High School. Their heating system was installed in 1993 at a total cost of \$600,000, which included a completely new piping and radiator system. With a total heated floor space of 80,000 square feet, the school saves more than \$40,000 in fuel costs annually. The local purchase of fuel also supports the regional economy.

### Rules of Thumb

- It takes roughly one ton per hour of wood waste to produce one megawatt of electricity.
- Typically, the most important factor in the cost of wood waste is transportation. Transporting wood-waste fuels more than 50 miles may not be economical.
- The heating value of wood waste (Btu/lb) can be approximated as  $(1 - m) \times 8500$ , where  $m$  is the fractional moisture content of the wood.
- Existing coal-fired power plants can often be co-fired with 10 percent wood residues with only minor plant modifications.

### For More Information

To find out more about biomass and wood-waste fuels or about using the BAMF Super ESPC to implement a wood-waste-to-energy project at your facility, please contact one of the following BAMF Super ESPC Program team members:

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### A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

For more information contact:  
EERE Information Center  
1-877-EERE-INF (1-877-337-3463)

[www.eere.energy.gov/femp](http://www.eere.energy.gov/femp)



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