

WISCONSIN WOOD PELLETS

Clean Renewable Energy for Generations



**An Environmental and Economic Opportunity
Leading to Energy Independence**

Introduction

Wisconsin faces many questions regarding energy, the environment and the economy. The three most important questions are:

1. How do we achieve energy independence?
2. How do we make our environment cleaner?
3. How can we improve our economy?

While there may be several solutions to these questions, Wisconsin has a partial solution it can implement today—not ten years from now. While Wisconsin imports \$12 billion of energy annually,¹ it is the steward of large forests. A managed forest can produce biomass energy that is sustainable forever. In addition, Wisconsin is home to numerous wood industries, including paper mills and sawmills, which produce wood waste.

The use of wood pellets from Wisconsin's forests and wood related industries is a path to energy independence and a better environment. Wood pellets can be burned for making steam for heating or can be used for the full range of energy applications, from residential heating to electricity generation.

Biomass energy from locally produced wood pellets made from the forests and wood related businesses of Wisconsin has many benefits over other types of energy. Wood pellets are a renewable energy, minimizing the burning of finite fossil fuels. The combustion of wood pellets produces less pollution than other fossil fuels, creating no sulfur oxides, and it is carbon neutral. Wood pellets can provide reliable electric power compared to other forms of alternative energy, create manufacturing jobs and improve the local and state economy.

Wood pellets are cleaner than coal, from a renewable Wisconsin source and will provide jobs within Wisconsin. Wood pellets are today's answer to energy independence and a cleaner environment and can contribute to a thriving local economy.

What Is Biomass Energy?

Biomass refers to living matter. Agricultural crops are biomass and have a value as both food and energy. The non-edible portions of crops, such as corn stover, can be used for animal feed or for energy. Energy crops, such as switchgrass, could provide a biomass resource, but switchgrass hasn't been established in sufficient volume to be a reliable energy source. Forest residue and other wood wastes are biomass that is suitable for energy production and not for food or feed. Wood wastes from sawmills, paper mills and other wood industries are readily available biomass.

Given proper forest management, biomass is an indefinitely sustainable, plentiful source of clean and renewable energy from the forests of Wisconsin.

What Are Wood Pellets?

Wood pellets are a refined and densified biomass fuel. They can be made from material rejected by wood product manufacturers. By pelletizing residual forest waste, sawdust, and used wood pallets, millions of tons of waste can be put to work for the Wisconsin economy while enhancing the environment at the same time. Agricultural products such as cornstalks and straw can also be pelletized.



Where Can Wood Pellets Be Used?

Wood pellets can be burned in residential stoves or can be co-fired in industrial, institutional or utility electric generation boilers that currently burn coal. In Wisconsin, sixteen state facilities have coal fired boilers. Each is a candidate for co-firing wood pellets with coal. Wood pellets are readily transportable from forested areas to anywhere in the state.

Approximately twenty manufacturing facilities in Wisconsin have coal fired boilers. Many of these are paper companies which are close to forest resources. Wood pellets can be made on-site from waste materials or at another location with forest residues.

More than twenty electric utility coal fired boilers are in operation in Wisconsin. Several have already tested biomass co-firing. Using wood pellets matched to the boiler will make it possible for more boilers to take advantage of co-firing biomass.

Wood Pellets Can Be Co-fired with Coal

Industrial and institutional boilers burn coal to make steam and electric utilities burn coal to make electricity. In 2006, 65% of Wisconsin electricity was generated from coal².

Wood chips are not as efficient a fuel as coal. Coal can be processed, usually by grinding, to improve its efficiency. Wood pellets improve the combustion characteristics and the friability of the wood so that they can be ground and co-fired with coal.

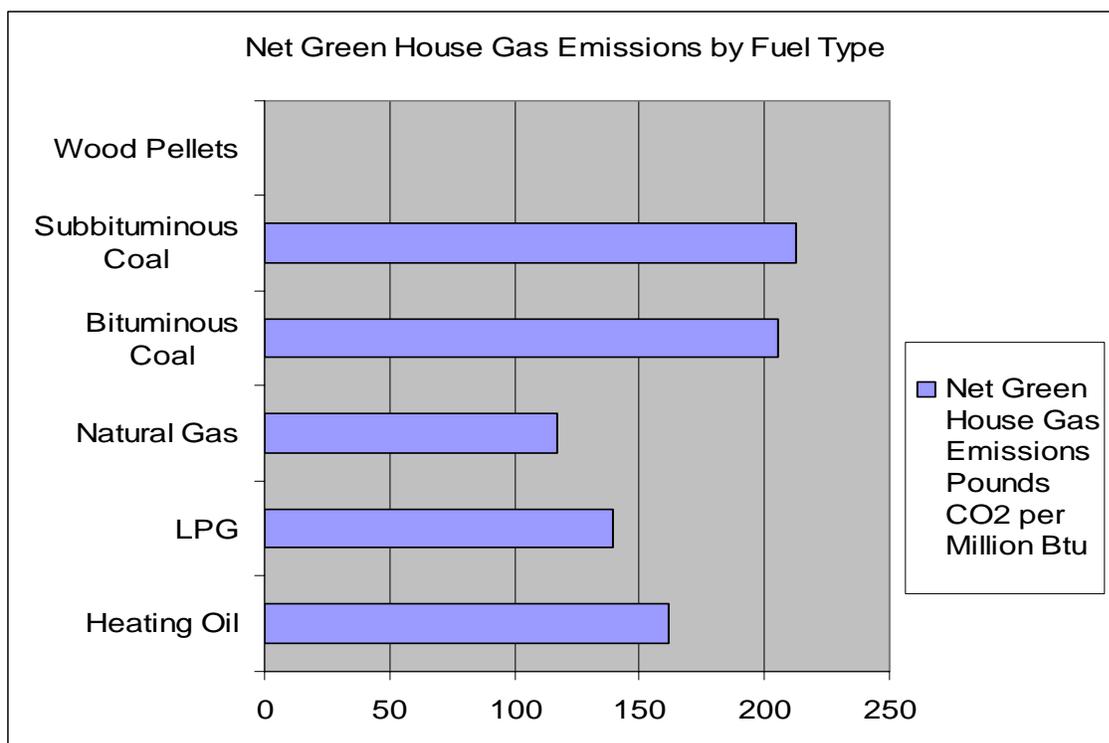
Wood pellets have several desirable features for co-firing with coal. By removing most of the moisture from the wood, wood pellets burn much like coal. The pellets are a consistent product, of a specific diameter and a range of lengths. They have a hard outer surface which makes

handling them similar to coal. They are also friable like coal, that is, they break into small particles when processed. That means that they can be mixed with the coal without the need for a separate system.

Depending upon the type of coal boiler, wood pellets can be fed into it in a couple of ways. In some cases, such as a fluidized bed boiler, the wood pellets can be fed with the coal through the same feeder system. In other cases, such as for some stoker coal boilers, a separate storage and injection system is required.

The Environmental Benefits of Wood Pellets

Biomass has several advantages over coal as a fuel. The growth of biomass captures CO₂ from the air. When the biomass is burned, it recycles the carbon into CO₂ that is available for new-growth biomass to capture. On the other hand, the burning of coal releases carbon which has been stored for millions of years.



Source: U.S. DOE EIA

Studies show that co-firing 10% biomass with coal reduces NO_x emissions by approximately 9%. Because biomass contains little if any sulfur, co-firing biomass with coal reduces the amount of SO₂ emissions. Biomass, unlike coal, does not contain mercury that has been accumulating in Wisconsin waterways. Co-firing biomass with coal would reduce proportionately the amount of mercury emissions. Biomass generally has less ash than coal and the ash by itself can be used as fertilizer.

There are several reasons for co-firing wood pellets with coal:

- **Wood pellet energy is carbon neutral.**
- **Coal is a limited resource, while wood is renewable.**
- **Co-firing wood pellets with coal means lower emissions.**
- **Burning wood as pellets means less to landfill.**
- **Coal plants can start burning wood pellets now.**
- **Wood pellets are cleaner to store and provide a safer work place.**
- **Wood pellet storage poses no soil or water contamination risks, nor does it pose a risk of explosion as does propane or natural gas.**

The Economic Advantages of Wood Pellets

In addition to improvements in the air and water quality in Wisconsin, co-firing biomass can produce several other benefits. Because coal is not mined in Wisconsin, using locally grown biomass will reduce the amount of coal imported into the state and improve the state's energy independence. Replacing 5% of the coal burned in the state will utilize 1 million tons of wood in 15 typical pellet mills. (Specifics are summarized in the Table on the next page.)

Wood pellet mills provide at least part of the solution to the continuing challenge Wisconsin and many other states in the north are having with pulp and paper mill closings. The wood supply that those pulp and paper mills use needs a productive place to go. Pellet mills are a big step in the right direction.

A typical pellet mill will produce 70,000 tons of pellets per year. This is enough to supply one 250 MW generating plant with 5% of its fuel as co-fired biomass. A 70,000 ton per year wood pellet mill will provide 10-15 high paying full time permanent jobs with a projected payroll of about \$500,000 per year. These are long term positions that can never be outsourced.

Nearly one hundred new related jobs will be created by a typical pellet plant as loggers respond to the opportunity to provide wood biomass to the plant. The plant will require 6,000 truckloads of wood biomass delivered and will ship approximately 2,500 truckloads of wood pellets out to customers per year. The plant will consume up to 150,000 tons of wood and wood waste per year. The income from this feedstock will initially be earned by regional landowners,

truckers and loggers and others supplying wood to the plant, however, the economic effect on the area surrounding the plant will be multiplied by approximately 2.4 times. All types of local businesses from local restaurants, shops and stores to larger businesses will benefit.

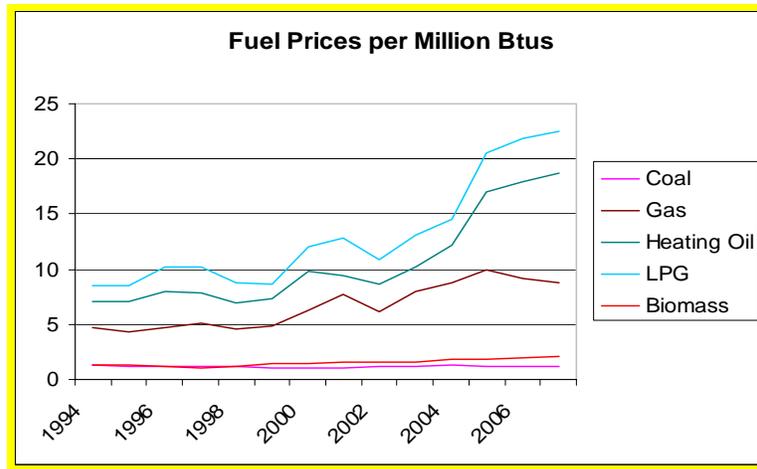
Finally, the initial plant construction will infuse millions of dollars into the region for wages, associated equipment and material, and once operating, the plant will be a significant taxpayer in the state and local area in the form of property taxes, sales tax and worker's compensation.

Permanent Jobs	Typical 70,000 Ton/Year Pellet Mill	15 Pellet Mills for 5% Co-firing by Utilities
Pellet Facility Operators	10-15	150-225
Loggers	30-50	450-750
Local Truckers	<u>5-10</u>	<u>75-150</u>
Total	45-75	675-1,125
Temporary Jobs		
Construction (Road and infrastructure upgrade jobs not included.)	50	750

Other Benefits of Wood Pellets:

- **Lower Moisture Content**
The moisture content of pellets is substantially lower than wood chips or cordwood (10% water—compared to up to 60% for green biomass). Less moisture means higher BTU value and easier handling especially in freezing situations with green raw biomass materials.
- **Ease and Cost of Transport**
The density of wood pellets is substantially higher than raw biomass (40 lbs. per cubic foot versus 10-25 lbs. per cubic foot in raw material form). More fuel can be transported in a given truck space. As a result, trucking fuel cost and vehicular emissions will be reduced.
- **Ease of Handling**
Their uniform shape and size allows for a smaller and simpler feed system that reduces costs.
- **Safe and Clean Workplace**
Wood Pellets pose none of the explosion risks or environmental pollution from spills as nonrenewable fossil fuels do.
- **Beneficial Ash Use**
In cases where wood pellets make up 100% of the fuel the ash residue can be used as a fertilizer.

- **Stable Fuel Price**



Source: U.S. DOE EIA

What are the Opportunities for the Wisconsin Economy?

The Wisconsin Renewable Portfolio Standard (RPS) requires electric utilities to generate increasing percentages of their electricity from renewable sources. Biomass co-firing is specifically addressed and utilities receive full credit for the biomass burned. Some renewable resources, such as wind energy, come from outside Wisconsin. Using renewable energy facilities from other states reduces Wisconsin's energy independence. Biomass from within Wisconsin should be encouraged by requiring in-state renewable resources through new legislation specific to pellet fuel.

The RPS currently applies to electric utilities. Other types of energy users are not required to, nor rewarded for, using renewable energy. From pellet stoves for residences to co-firing in industrial or institutional coal boilers or biomass boilers, more Wisconsin residents would use renewable energy if they benefited economically in addition to being good stewards of the environment. In conclusion, Wisconsin should require in-state biomass and expand the biomass co-firing program to industrial and institutional boilers.

How Does Biomass Co-firing Compare to Wind Energy?

Wisconsin has limited wind resources. Electric utilities wanting to use wind energy to satisfy their RPS requirement may contract for it from other states, such as, Minnesota or South Dakota. Co-firing biomass from Wisconsin satisfies the RPS and would provide local benefits in terms of jobs. For renewable energy from out of state wind farms, utility customers incur the cost with no direct benefits to Wisconsin.

Co-firing biomass would require minimal to substantial modification of a coal boiler. Co-firing wood pellets would likely require the least modification. Because co-firing uses existing

generating capacity, the utility satisfies its renewable requirement while maintaining the ability to operate reliably. Wind farms produce electricity when the wind blows, which is, being optimistic, 25% to 35% of the time. Wind generation needs a backup or redundant source of power. Because wind is unpredictable, it needs other generators to compensate for the variations and is not necessarily available at the times of highest need—in fact it can be available at night or on the weekend when usage is much lower which requires lower cost generators to reduce output or shutdown. Because the value of unpredictable energy is substantially less than that of controllable energy, such as from a co-fired coal plant, co-firing wood pellets is competitive with wind generation.

How Can Wisconsin Expand Wood Pellet Use?

Wisconsin has enacted incentives for biomass use. Through the Focus on Energy, it offers rebates and grants for biomass systems for non-residential installations. It is also working with a Forest Service grant to establish a biomass commodity exchange and has commissioned a strategic assessment of co-firing biomass in Wisconsin³.

Three markets exist for pellet energy:

1. State Facilities

The state facilities burning coal can be easily analyzed. With a processed fuel such as wood pellets or other compacted biomass, state owned coal boilers could quickly implement a co-firing program and begin reaping the benefits. The state may need to modify some of its facilities.

2. Electric Utilities

The electric utilities are another viable market. They have already tested and demonstrated various types of biomass co-firing. The reported challenges with most of the tests could be mitigated by the use of wood pellets or other compacted biomass. In addition to taking credit for the biomass under the RPS, the utilities may need further incentives to undertake this change to their operations. Specific pellet legislation would trigger implementation with the resulting benefits to the Wisconsin economy and environment.

3. Industrial Market

The industrial and institutional market of coal users would complement the other two markets. These companies are not required to meet the RPS. They are also not eligible for Focus on Energy grants because they would not save natural gas or electricity. Wisconsin should extend the Focus on Energy grants to include co-firing biomass with coal or provide tax and financing incentives to aid them in implementing pellet use.

The Bottom Line...

Setting energy policy requires tough decisions, weighing risks and rewards and even predicting the next turn in world events. Wood pellet fuel should play a part in putting Wisconsin ahead in all those areas. It will encourage the economic and energy independence of our communities, reduce costs and clean the air. It is a solution waiting to be implemented today.

Overall, Wisconsin is well situated with extensive forest resources to expand the use of biomass through co-firing wood pellets with coal. By demonstrating with state owned facilities that wood pellet co-firing is beneficial, Wisconsin can lead the way for institutional, utility and industrial boilers to co-fire biomass with coal. The state will be improving its economy as well as improving its environment and increasing its energy independence.

Let's get started for a:

- Stronger State Economy
- Cleaner Environment
- Cost Effective Renewable Energy
- An Independent Energy Future

...What Can You Do Today?

Co-firing wood pellets produced from locally harvested wood from Wisconsin forests or the wood waste products of Wisconsin businesses is a win-win situation for the economy and environment of Wisconsin. Whether you are a legislator, administrator, business owner, factory manager, energy consultant, or anyone who wants to help the Wisconsin and local economy, protect our environment and advance a very efficient thermal energy—you have a unique opportunity: spread the good news and promote the use of wood pellets for heating and energy generation.

¹ John Muir Chapter of the Sierra Club, www.wisconsin.sierraclub.org

² U.S. DOE EIA Wisconsin Table 5, Electric Power Industry Generation by Primary Energy Source, 1990 Through 2006 (Megawatthours)

³ “Co-Burning Biomass Opportunities in Wisconsin A Strategic Assessment”, Final Report for Contract No. 80081, for the Division of Energy, Wisconsin Department of Administration, U.S. Department of Energy Contract DE-FG45-99R530438, June 2001

Sources:

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U.S. DOE EIA (www.eia.doe.gov)

Pellet Fuels Institute (www.pelletheat.org) provided photographs

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