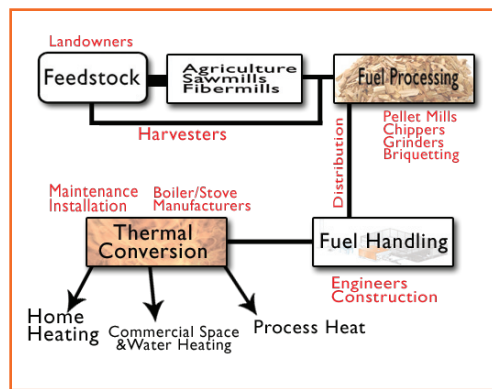


Biomass Thermal Market Overview

There are numerous benefits to using biomass instead of fossil fuels like oil, coal, and gas for providing heat for homes, commercial users, and industrial processes.

Biomass heating is not a new technology, but that is not to say that it is not rapidly advancing. Take for example one use of biomass, home heating. There are currently millions of Environmental Protection Agency (EPA) certified wood stoves in use in American homes. Annual sales of highly efficient wood and pellet stoves have reached into the hundreds of thousands, and domestic pellet demand is increasing. A broader view of the biomass thermal market reveals that thousands of commercial buildings and industrial facilities are currently realizing the cost saving potential of local biomass resources for the production of both heat and electricity.

Biomass heating is not a "niche" technology. According to the U.S. Energy Information Administration (EIA), consumption of biomass for thermal applications totaled 2.4 quadrillion BTUs in 2008, with the majority serving the industrial sector¹. In comparison, the total amount of renewable energy (including thermal, transportation, and electricity) consumed across all sectors that year was 7.4 quadrillion BTUs. As the demand for renewable energy increases, biomass heating can fulfill demand with a supply chain that supports local jobs.



The Biomass Supply Chain

The biomass thermal supply chain operates in stark contrast to other traditional energy sources, such as petroleum. For example, heating oil (a fuel commonly replaced with biomass) is produced through a supply chain that extracts raw material from around the globe, refines the material abroad, and is then shipped thousands of miles to the end user. By comparison, the biomass supply chain operates locally (typically 200 miles or less), ensuring that revenue is generated locally, and transportation costs are kept to a minimum.

The biomass thermal supply chain usually begins with the traditional timber and

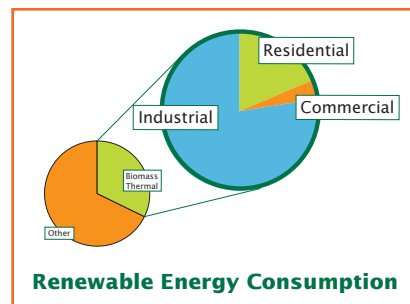
agricultural supply chain: landowners, harvesting contractors, and processing facilities. This is because biomass for heating is often sourced from the byproducts of agricultural and wood processing facilities. As the market expands and demand increases, more biomass suppliers will mimic the traditional wood supply chain by harvesting fuels directly from forests or other dedicated energy crops.

A number of studies have been conducted in recent years to estimate the amount of biomass available for energy generation on a regional and national scale. The results are highly variable due to the array of assumptions utilized in the calculations. For example, a 2005 study by the National Renewable Energy Laboratory concluded that there is potentially

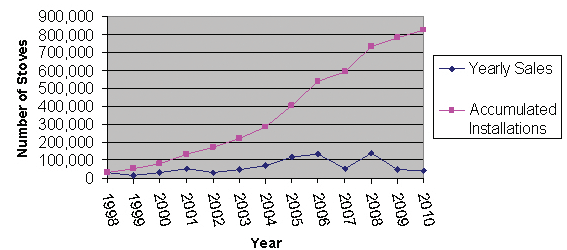
460 million tons² of biomass available in the US. Another study, from the same year, found the figure to be over 1 billion tons³. Though the results of these studies differ, a common conclusion can be drawn from them: the potential biomass supply is both substantial and diverse enough to sustainably support a growing biomass heating market.

Sectors of the Market

The biomass heating market is typically split into three sectors: residential, commercial, and industrial. The adjacent figure shows the relative proportion of these three sectors to the total biomass thermal usage. Biomass thermal energy accounts for 32% of the total renewable energy consumed in the U.S.



Pellet Stove Sales



(Source: Hearth, Patio, and Barbecue Association (HPBA), (2010). Hearth Industry Unit Shipments)

Residential Market

According to the 2009 American Housing Survey there are about 12 million American homes equipped with wood stoves which are being used for either primary or secondary heating purposes⁴. A similar yearly census study, The American Community Survey, suggests that the number of occupied housing units that listed wood as the "fuel most used" for heating is on the rise. According to the American Community Survey, 2.3 million American homes use wood as their main fuel source.

Pellets

Densified biomass in the form of pellets represents one of the fastest growing portions of the biomass heating market⁵. Of the 2 million tons of pellets produced in the United States in 2008, 80% were shipped to in-country destinations⁶. Although pellet-fueled commercial boilers are gaining traction in the United States, most of the domestic demand for pellets is driven by the residential sector. A recent surge in pellet mills has led to some mills operating below capacity; however, the growing number of biomass energy facilities and renewed domestic interest in pellets due to high oil prices, should increase demand.

Other types of residential biomass fuels like cordwood and forest residues, are difficult to track because their distribution is decentralized as they are often collected from private lands.

The potential for future growth of the biomass thermal market in the residential sector is perhaps best exemplified by Austria, a country which was highly dependent on heating oil until twenty years ago. In the mid-1990's automatic pellet heating systems were introduced

¹ EIA Renewable Energy Annual. (2008). Renewable Energy Consumption for Nonelectric Use by Energy Use Sector and Energy Source. 2010

² Milbrant, A. (2005). A Geographic Perspective on the Current Biomass Resource Availability in the United States.

³ Perlack, R. (2005). The Technical Feasibility of a Billion-Ton Annual Supply. USDA/DOE.

⁴ US Department of Housing and Urban Development, (2009). American Housing Survey for the United States: 2009. Retrieved from: <http://www.census.gov/prod/2011pubs/h150-09.pdf>

⁵ Rickerson, W. (2009). The emergence of renewable heating and cooling policy in the United States. *Policy and Society*.

⁶ USDA (2009). North America's Wood Pellet Sector.

and have since experienced high market penetration. Today, 65% of new homes in Upper Austria are built with centralized wood pellet boilers⁷. Biomass heating technology now provides 31% of the total thermal energy for the state.

Industrial and Commercial Markets

The industrial sector represents the greatest share of biomass thermal consumption due to the huge thermal load of each individual boiler. Often industrial biomass boilers use biomass feedstock unique to the industry to generate useful thermal energy or combined heat and power (CHP).

The Environmental Protection Agency (EPA) classifies industrial biomass boilers into two categories based on their emission profiles: large boilers are known as 'Major Sources', and smaller scale boilers are classified as 'Area Sources'. The EPA has concluded that there are 420 Major Source and approximately 11,000 Area Source biomass boilers in operation. It is estimated that in the next two years another 200 Area Source Boilers will become operational⁸.

Viable markets for CHP applications exist both in rural/agricultural and urban municipal settings⁹. Currently, there are over 500 CHP units in operation across 44 states, that consume a wide variety of biomass fuels. Out of this total, 151 units specifically burn wood. Applications range from agriculture, manufacturing, and textiles to school, office, and government buildings¹⁰.

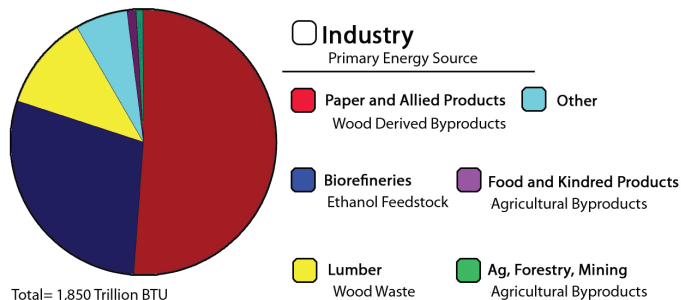
Market Drivers/Opportunities

There are a number of market drivers that have been identified which will help to propel biomass towards a greater share of the heating market:

- **Biomass Fuel Cost and Availability:** Biomass is available locally almost anywhere in the United States, and has a more stable price than heating oil because its cost does not depend on international markets and politics.

- **Conventional Fuel Price Volatility:** Conventional fuel prices fluctuate greatly in the short term, and are expected to rise in the long term.
- **Education:** Education of consumers, as well as boiler and feedstock owners, on the benefits of biomass heating is important.
- **Incentives and Regulations:** Adoption of additional incentives and regulations which recognize the benefits of biomass heating can foster a stronger market.
- **Rural Economic Development:** Local supply chains can benefit from initiatives supporting biomass thermal energy and rural development.
- **Energy Security:** Biomass heating can directly displace consumption of foreign oil and strengthen our energy independence.
- **Environmental Considerations:** Modern

Industrial Thermal Biomass Consumption



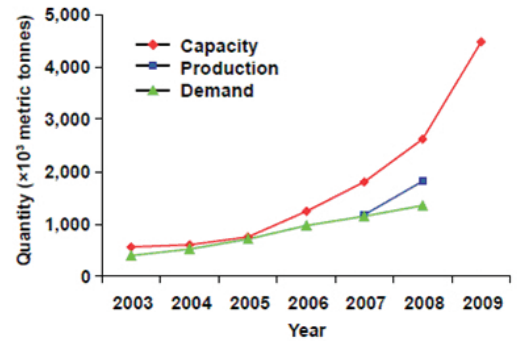
Source: EIA Renewable Energy Annual 2008. Industrial Biomass Energy Consumption and Electricity Net Generation by Industry and Energy Source. 2010.

biomass combustion minimizes particulate emissions and does not contribute to a net increase of carbon in the atmosphere.

Demand/Competition

The primary biomass energy fuel source is wood. The potential effect of utilizing wood for biomass energy purposes on conventional forest production supply chains was the subject of a 2011 study, which concluded:

“The forest products industry is in an ideal position to take advantage of the burgeoning wood-energy market as the industry already has a wood supply chain in place and owns a majority of the CHP capacity in the United States. Furthermore, with the pulp and paper



Capacity, production, and domestic demand for wood pellets in the United States.

(Source: USDA, (2009) North Americas Wood Pellet Sector)

industry struggling to stay competitive globally, producing energy could provide an additional market and help the sector remain competitive while also achieving the societal desire for renewable energy”¹¹.

Conclusion

The United States has a diverse, increasing supply of biomass feedstock, mature combustion technologies, and a growing biomass industry. Equally diverse is the scope of thermal applications; ranging from a single home to an entire industrial operation. Biomass thermal already contributes a great share to the total renewable energy supply in the United States, and has the potential to meet a greater demand as the market continues to expand into the future.



The work upon which this publication is based was funded in whole or in part through a grant awarded by the Wood Education and Resource Center, Northeastern Area State and Private Forestry, U.S. Forest Service. This institution is an equal opportunity provider.

This fact sheet is available online at www.biomassthermal.org.

⁷ Verma, V.K. (2009). Small scale biomass heating systems: Standards, quality labeling and market driving factors – An EU outlook. *Biomass and Bioenergy*.

⁸ EPA Boiler MACT proposal (2010). Federal Register Vol. 75 no. 107

⁹ NREL, (2008). Initial Market Assessment for Biomass-Based Small-Scale CHP.

¹⁰ CHP Database. Energy and Environmental Analysis Inc./ICF <http://www.eea-inc.com/chpdata>

¹¹ Conrad, Joseph. (2011). Wood-energy market impact on competition, procurement practices, and profitability of landowners and forest products industry in the U.S. South. *Biomass and Bioenergy*.