



# Transforming Wood Heat in America

A Toolkit of Policy Options

July 2011



**ALLIANCE**  
**FOR GREEN HEAT**  
clean, renewable & local

## Executive Summary

As traditional fossil fuel prices continue to rise and concerns about environmental impacts and dependency on foreign oil deepen, governments are increasingly turning to renewable energy. Modern wood heat systems should be part of all federal and state renewable energy programs. With wood heat, our challenge is to phase out and change-out dirtier and less efficient stoves and boilers, and start incentivizing the cleanest ones. We are far behind Europe in the process, but in recent years, scores of officials and policy makers are starting to look at harnessing the potential of modern, high efficient wood heat.

Wood heat is by far the most common residential renewable energy in America with about 2% of the population using it as a primary heating system, and 8% of the population using it for secondary heat. Because of the sheer number of installations, estimated at about 15 million units by the DOE, wood heat offsets far more fossil fuel than all the other residential renewable energies combined – solar PV, solar thermal, geothermal and wind. By the yardstick of reducing fossil fuel wood heat is a renewable energy success story. However about 75% of the existing installations of wood and pellet systems in the U.S. are outdated and too polluting. This report explains how we can harness the capacity of biomass heat by incentivizing the cleanest stoves and boilers, and switching more rapidly to pellet systems instead of cord wood, as Europe has done.



The Alliance for Green Heat interviewed over 150 stakeholders for this project including air quality experts, foresters, incentive program officers, industry leaders, manufacturers, EPA regulators and

many others. In addition, a Wood Heat Task Force from these stakeholder groups provided extensive input and feedback. The full document with sources and footnotes (which were not included in this version) can be **found online at [www.forgreeheat.org/resources/toolkit](http://www.forgreeheat.org/resources/toolkit)**

**Federal** – Years ago, wood heat became an energy efficiency measure, not a renewable energy in Congressional incentive policy. This has left even the very best wood heat technologies

with only a 10% tax credit up to \$300, whereas other residential renewable energy systems like solar and geothermal receive 30% with no cap. In Europe modern, high efficiency wood and pellet systems often receive ten times that support, on par with other renewable energies. Since modern wood heat is a cost effective way to move the country towards less dependence on fossil fuel and is affordable to low and middle-income families, it makes little sense for it to be left out of the federal *renewable energy* tax policy.

**State** - Some state renewable energy programs are beginning to include biomass appliances. Three of the most prominent state-wide programs are the Oregon and Montana tax credit for stoves and the New Hampshire rebate for pellet boilers. Alabama provides a tax deduction to switch from electric or gas heat. Five states have low interest loan programs that include wood burning appliances. Other state rebate programs have expired. Several states have long-standing incentive programs to change out older stoves, and replace them with new EPA certified ones including Idaho and parts of California and Washington state. Both Vermont and Michigan had statewide rebates for changeouts that have expired. While these programs are primarily designed for air quality goals, they also are a very cost-effective ways to more efficiently produce renewable energy and reduce fossil fuel use.

In states that do not include modern, high efficiency wood heat in renewable energy programs, interviews with incentive program managers reveal that there is no consistent reason why modern wood systems have not been included.

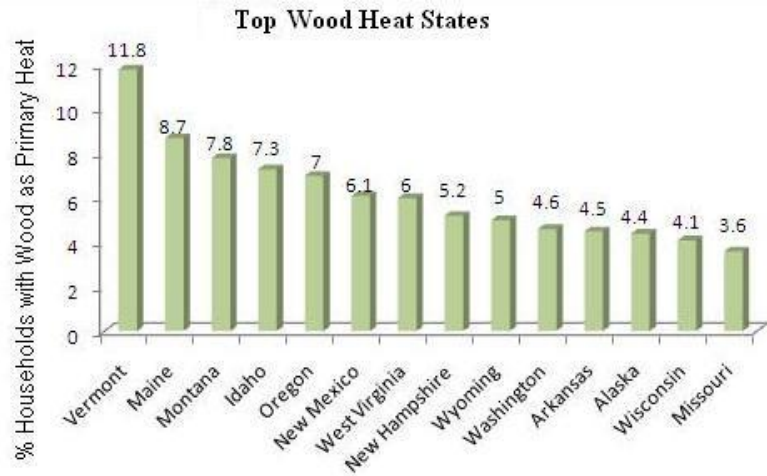


Figure 1: Top Wood Burning States (US Census Bureau)

## Key Recommendations

- Renewable Energy Incentives:** Federal and state renewable energy programs should work to include the cleanest, most efficient wood/pellet stoves and boilers. Compared to other renewable, wood heat requires much smaller incentives and can help many more families, particularly lower income families, to quickly reduce fossil fuel heat. Renewable energy/ energy efficiency programs should include pellet appliances in both urban and suburban programs, but may want to restrict incentives for wood appliances to rural areas. To date, renewable energy incentives have mainly gone to very wealthy families.
- New Source Performance Standards for Wood Burning Appliances:** The EPA is currently undertaking New Source Performance Standards (NSPS) for wood heating appliances. Stricter emission and efficiency standards are needed for all major wood burning appliances. Mandatory emission limits are now being developed for pellet appliances, indoor and outdoor wood boilers and other appliance classes which is an important step for incentive programs. Additionally, all installations, including installation of second hand stoves, should be required to be EPA certified, as they are in Washington and Oregon.
- Research & Development:** The Department of Energy should be urged to support research and development of next generation thermal biomass systems. The DOE provides extensive support and funding for less efficient uses of biomass: biofuels and biomass for electricity while there is tremendous untapped potential in developing clean and efficient biomass heating systems at the residential and institutional level. Europe is outpacing the U.S. in this area, particularly in the development of automated pellet boilers that come with thermal storage and can be inter-connected with other renewable energy systems.
- Changeout Old Appliances:** Programs to changeout existing outdated wood appliances with modern efficient equipment are crucial to efforts to modernize America's

aging fleet of wood heating stoves and boilers that cause air quality issues. The EPA could focus more funds toward this and local jurisdictions should ensure that heavily polluting equipment is not re-installed in an area that has conducted a changeout program- as is too often the case. Changeouts should first focus on lower income families that use their stove or boiler as a primary or substantial secondary heat source. Additionally changeout programs should invest in education and outreach as clean burning education is vital to ensuring the new stoves are utilized as cleanly as possible.

- Energy Star:** An Energy Star programs for wood and pellet stoves would steer consumers toward the cleanest and most efficient appliances. Higher efficiency wood and pellet equipment are more effective at quickly and cleanly reducing fossil fuel heat and consumers would benefit from a recognizable and trusted way to make purchasing decisions.
- Low Income Heating Assistance:** State energy assistance directors should consider providing full subsidies to qualified families to replace an existing uncertified stove with a new efficient wood burning device if the family uses wood as a heat source. The State of Montana has shown this to be a cost effective measure for LIHEAP programs. Additionally, benefits should not be primarily based on per unit price of fuel, which favors the highest priced fossil fuels and discriminates against the lower priced renewable fuel of wood. Under this system, families are more likely to choose a benefit for fossil fuels, instead of a locally produced renewable fuel. This disincentive to use more wood keeps energy dollars flowing out of the state, and often out of the country.

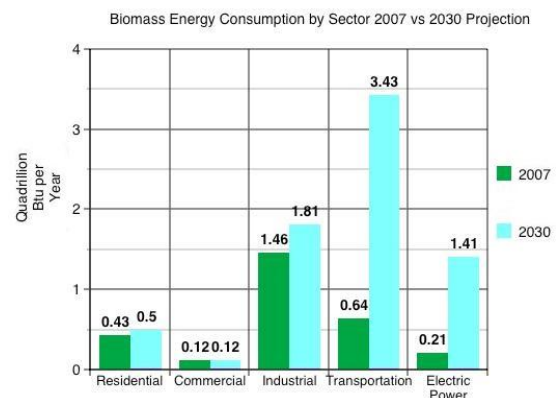


Figure 2: Biomass Usage Projection. Based on current policies and incentive structures, the EIA projects America's use of biomass to soar in transportation and electric power - its least efficient uses.

## Wood Heat in America

Wood is used by 2.8 million American homes as a primary heating fuel and 8.8 million homes as a secondary heating fuel, comprising about 10% of US households. Wood heat provides 80% of all residential renewable energy- solar provides 15% and geothermal 5% (EIA). Between 2000 and 2009, wood heat use increased in 37 states.

Despite the dominance of wood heat in residential renewable energy production, most wood stoves in use today are too old and polluting. This report reviews policy options to deploy modern, cleaner burning stoves and to change out older ones.

Around two thirds of wood for heating is self harvested and wood or pellets can be purchased for much less than the cost of electric, oil or propane heat. Unlike other uses of biomass, such as electricity and liquid fuel that only utilizes 25%-50% of the energy contained in the fuel, biomass used for heat can capture up to 90% of the energy in the wood.

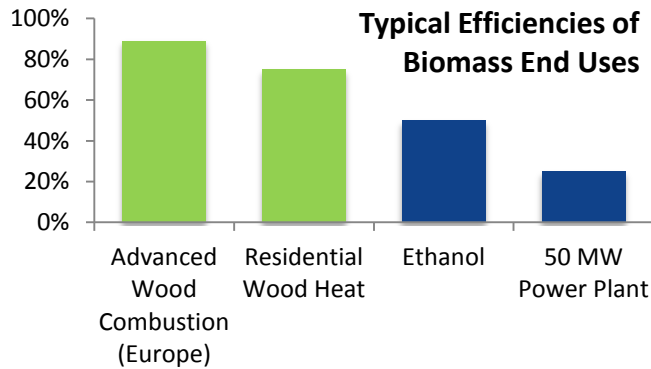


Figure 3: Average Efficiencies of Biomass End Uses (Pinchot Institute)

The wood heat industry is a domestic industry composed of many sectors, and is a significant source of US jobs. The Hearth Industry alone is valued at roughly five billion a year.

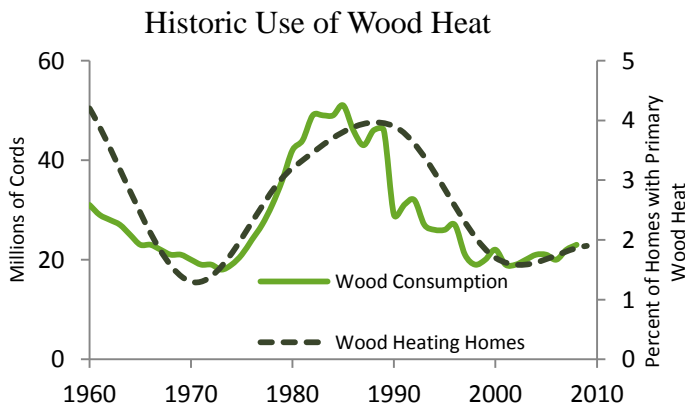


Figure 4: Historic Use of Wood Heat (US Census & EIA)

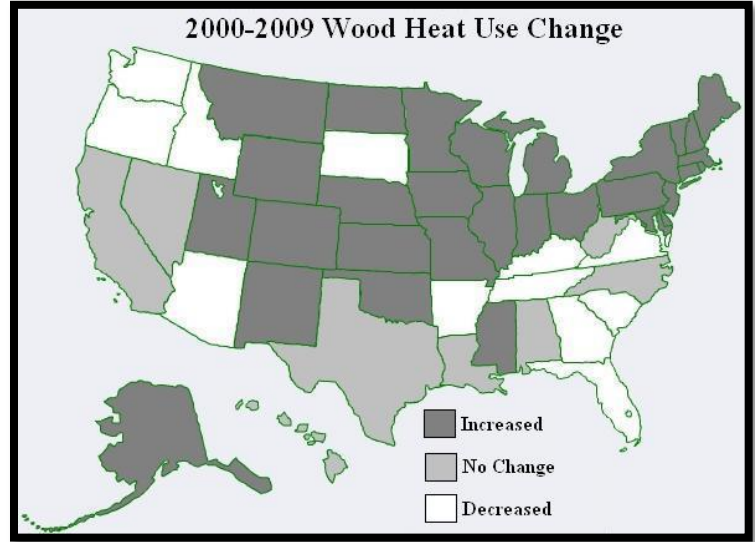


Figure 5: 2000-2009 Change in Wood Heating Use (US Census)

The Department of Energy calculates that 23 million cords of firewood are combusted for residential heating purposes annually and residential wood heating expenditures are almost \$1.5 billion per year.

The advances in reducing emissions from biomass stoves and furnaces in the US have been largely the result of engineering innovation in the private sector with virtually no government support for research and development. Although the Department of Energy funds research and development for other renewables, as well as ethanol production from biomass, investment in the biomass heating sector is notably absent.

### Federal or state incentives could spur a wave of new technological advances, making stoves even cleaner burning and more efficient as they have in Europe.

Residential wood heat is responsible for reducing far more fossil fuel use than residential solar, geothermal and wind. A wood or pellet stove, purchased and installed for \$2,000 to \$4,000, can replace enough fossil fuels to displace 2-4 tons of carbon a year, the same as a typical residential solar PV system which can cost 10 times as much. State and Federal renewable energy programs have often overlooked the vast potential of this residential energy source, but the advent of much cleaner pellet and wood technologies is causing many program developers to take a second look.

Wood is often the only heating fuel that low and middle income household can afford. Incentive programs can make pellet stoves and EPA certified wood stoves affordable to families who may otherwise buy a second hand stove that is inefficient and too polluting or continue to operate an uncertified stove.

## Benefits of Wood Heat

Wood is a unique renewable heating fuel with advantages over both fossil fuels and other renewable energies. It can combine the low carbon benefits of other renewable energy with an affordability to rival or exceed the least costly fossil fuel currently used for heating- natural gas. Wood can also reduce foreign oil dependency, cushion homeowners from volatile fossil fuel price fluctuations and keep money in communities while creating jobs.

Biomass heat fulfills the same public policy objectives that are the basis for the incentives and subsidies that other renewable energies receive, such as reducing consumption of foreign oil to increase American energy independence, reducing emissions of greenhouse gasses and air pollutants such as mercury and sulfur dioxides, and strengthening local economic development and job creation. Despite the widespread use of traditional wood stoves, modern biomass combustion systems have a relatively small market penetration and pose a significant price barrier to consumers- especially the low-middle income consumers to whom renewable energy technology is financially out of reach.

**Incentive programs help lower the per unit cost of the cleanest equipment, improve air quality and help ordinary families affordably heat their homes.**

Biomass for heating use is a low carbon energy source- primarily because the carbon released from combustion of wood does not add to the existing atmospheric carbon pool. Given that forests are managed sustainably, the carbon released from burning wood is sequestered by the next generation of growth.

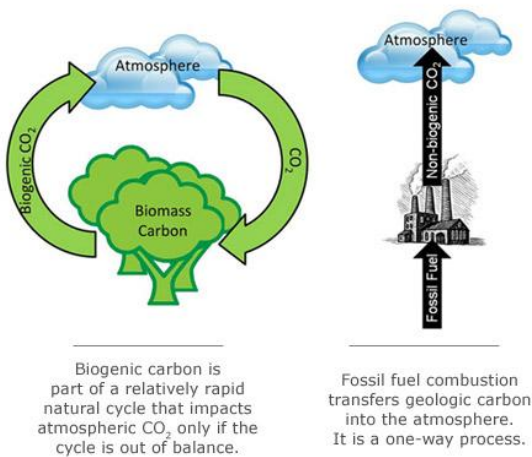


Figure 6: Carbon Pathways (Washington Forest Protection Association)

Since the scale of residential biomass heat is much smaller than biomass for ethanol or electricity, and has a more favorable carbon profile, residential biomass heat is considered an almost zero carbon heating source- provided sustainable forestry practices are employed. Biomass heat is a renewable energy that

can significantly reduced fossil fuel use with a low carbon sustainable alternative.

A wood or pellet stove can be the primary source of heat for average or smaller homes, but since pellet stoves are much more likely to provide heat 24/7 as they automatically feed the fuel, they typically displace more fossil fuel per home. *Purchased* cordwood prices are often comparable to natural gas and both cordwood and pellets are significantly less expensive than fuel oil, propane or electricity. The advantage biomass has over these fuels in addition to affordability, is that wood is both renewable and local. The money spent on home heating remains in the local economy, and circulates locally as well.

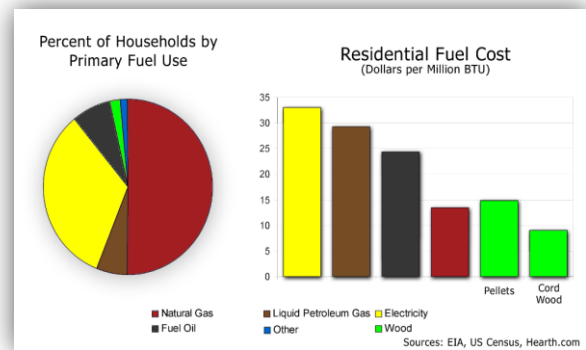


Figure 7: Household Fuel Use & Cost (Biomass Thermal Energy Council)

Biomass heat benefits rural and forested economies across the country. The firewood industry employs tens of thousands of rural Americans and the hearth industry employs many more.

Numerous reports document the "heat or eat" dilemma in America. Low-income households have lower food expenditures and worse nutritional outcomes than richer families during cold-weather periods. Wood stoves help mitigate this problem in rural areas where families typically collect or harvest their own wood. Greater energy assistance funding for installing efficient EPA certified wood stoves could decrease energy and food insecurity.

Other renewable energies depend on an uncapped US tax credit of 30% of the purchase cost- which ranges up to \$15,000. However 30% of the cost of a typical wood stove purchase can cost less than \$1,000. Wood heat opens doors to a local renewable energy future that even low-income Americans can participate in.

| Technology     | Cost              |
|----------------|-------------------|
| Wind           | \$6,000 - 30,000  |
| Solar PV       | \$16,000 - 20,800 |
| Geothermal     | \$7,500 - 14,000  |
| Pellet stove   | \$1,200 - 4,000   |
| Wood stove     | \$1,000 - 3,000   |
| Masonry stove  | \$7,000 - 15,000  |
| Biomass boiler | \$7,000 - 20,000  |

## Key Environmental Issues

Particulate emissions are the primary issue with wood heating. Other concerns, such as sustainability of supply and high initial CO<sub>2</sub> release, are much less of a concern than many people assume. An emerging issue which needs to be addressed more aggressively is the transportation of pests in firewood

**Emissions:** The combustion of biomass releases a wide variety of pollutants into the air, including incompletely combusted particles known as particulates. These particulates are a health concern, especially in areas where high concentrations build up. Older adults, young children and those suffering from heart or lung diseases face an increased risk of complications from breathing particles found in the smoke from older, inefficient wood stoves. The cleanest burning modern stoves have drastically reduced indoor and outdoor particulates. Scores of mitigation strategies can be employed in those areas to improve air quality, including restricting new installations. Incentive programs provide the government with leverage to steer consumers towards the cleanest burning appliances or to only incentivize pellet appliances in densely populated areas. Retiring millions of older wood stoves and traditional outdoor boilers will be a challenge for years to come. Mandatory and stricter emission limits for technologies such as the outdoor wood boiler have been needed for many years. The lack of stricter EPA standards has contributed to the level of excessive wood smoke in many communities.

**Comparison of Biomass Appliance Emission Rates**

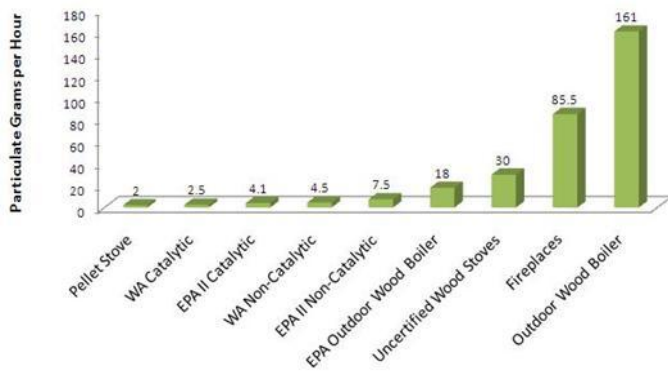


Figure 8: Biomass Appliance Emission Rates (EPA, AGH, WA State). \*WA Non-Catalytic stoves include masonry stoves.

*Strategies for Reducing Residential Wood Smoke*  
Air Quality Planning Division, EPA  
<http://www.forgreenheat.org/resources/10-09.pdf>

**Sustainability:** A commonly expressed concern about wood heat is the impact on the forests, especially if growth of wood appliances is expected. However, wood harvesting for residential use is unique. First about two thirds of homeowners harvest or

gather their own firewood, often from down or dead wood, resulting in a very small ecological impact. Firewood harvesting also generally has a light impact due to its scale and decentralized nature. Second both pellet and cordwood supply often comes from waste wood sources: A large percentage of purchased cord wood comes from tree trimming services in urban and suburban areas and pellets for domestic heating are primarily created from sawdust residues. Additionally cordwood harvesting in the US in the last several decades has not been linked by any study or report as being a significant threat to sustainability of forests. The height of cordwood harvesting was in 1985 when over 50 million cords were harvested: today's harvest is less than half that number.

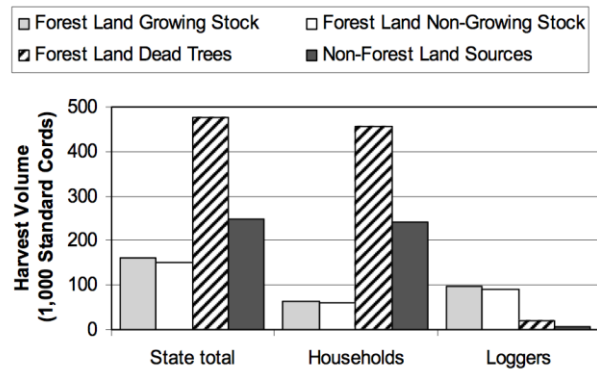


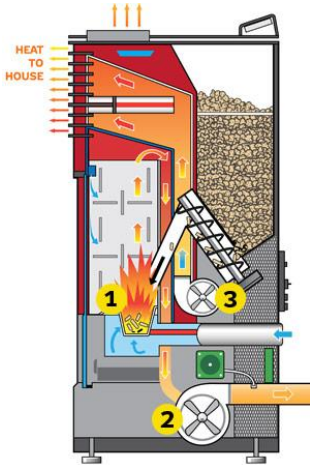
Figure 9: Volume of Fuelwood Harvested by Fuel Source (MN Dept. of Natural Resources)

**Carbon:** The issues surrounding the initial CO<sub>2</sub> release are complex, but because of harvesting patterns and high combustion efficiency, residential wood heat provides significant carbon savings compared to fossil fuels. Even the Manomet Center for Conservation Sciences' controversial "Study of Wood Biomass Energy" in 2010 concluded that *thermal* biomass can drastically reduce net carbon emissions compared to fossil fuels. Additionally, a peer reviewed 2006 Australian firewood study found that, "The use of firewood for domestic heating has lower net CO<sub>2</sub> emissions than non-renewable energy sources such as gas and electricity, particularly when firewood is collected from thinning slash and other residues of commercially grown plantations."

**Invasive Pests:** Pest transportation poses very real challenges in firewood, and requires careful management and consideration. Many of the cases of pest transportation involve firewood brought to campgrounds, not for home heating. Regardless, safeguards are being developed to minimize the transportation of invasive species from overseas and within the US such as the emerald ash bore or the Asian longhorn beetle. Un-paralleled cooperation amongst producers of firewood, the forestry community, agencies and the public will be necessary.

## Appliance Types & Policy Considerations

Each biomass heating technology presents unique issues and benefits. Not all technologies are suited for every geographic area or incentive program. Some wood burning appliance classes are better suited for the needs of low-income households, some are designed to burn very cleanly and eliminate user error so as to be well suited for areas with air quality issues, while others are better able to heat whole homes and optimally displace fossil fuels.

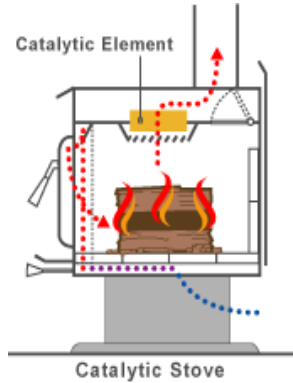
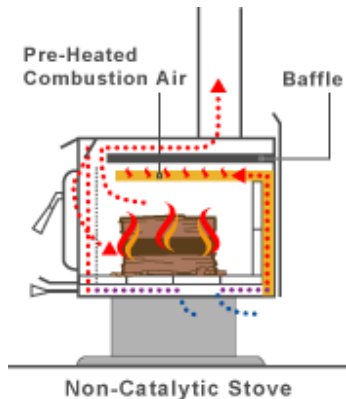


*The pellet stove* represents innovation in wood combustion because it blends traditional wood heat with automation and convenience. Pellets revolutionized wood heat by densifying the fuel to make it more efficient to transport. Furthermore, the relatively uniform low moisture content of the fuel, uniform size and automated burn system removed much of the user error associated with traditional wood burning. Due to the relatively low, consistent emissions of pellet

stoves, they are well suited for suburban and even urban environments. The price difference between pellets and wood stoves is important to consider when designing programs as pellet stoves require purchased fuel (unlike potentially self-harvested cordwood).

**Policy Considerations:** Incentive programs are widely regarded as important to launching this technology and promoting its wider deployment as a cleaner and more automated option than other stoves. Some European incentive programs have focused on pellet appliances for this reason. A pellet certification program run by the Pellet Fuels Institute is coming online in the fall of 2011 and will bring greater consistency of pellets for the consumer.

*The modern wood stove* emerged in the late 1980s after Oregon established emissions requirements which were then adopted by the EPA as national requirements. The Phase II EPA certification requires non-catalytic wood stoves to emit no more than 7.5 grams of particulates per hour (g/hr) and catalytic wood



in a catalytic stove should be replaced every seven years or so to ensure continued low emissions.

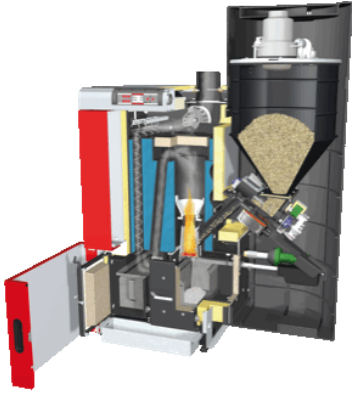
**Policy Considerations:** In rural areas, wood stoves are a good option for incentive programs (particularly for low-income families) that seek to reduce fossil fuel usage, and can be targeted towards families who heat with oil or electricity if the state has a mandate to reduce electricity usage. Wood stoves are also particularly suited to rural areas where electricity outages are an issue as they can continue to heat the home without any electricity.



*Masonry stoves* are widely used in Europe as whole house heaters whereas they are relatively rare in the US. They have a small, powerful firebox and a large masonry mass. Masonry stoves require less fuel and can radiate the heat from a single fire for

much longer than smaller stove styles. Masonry stoves generally emit between 18 and 24 hours of radiant heat from a single burn period. Some high thermal mass units on the market today can produce 30 or more hours of heat.

**Policy considerations:** The EPA is regulating the emissions from masonry stoves as of 2014, which will make them easier to include in incentive programs. Two states (CO, WA) already have emission limits, and many stoves have very low emission profiles. Masonry stoves can be considered whole house heaters, even though they typically require back up heating systems.

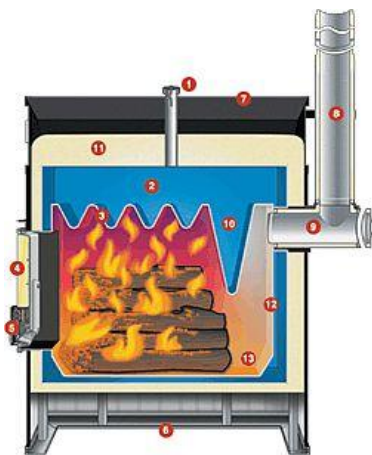


### **Indoor wood and pellet boilers and furnaces**

are widespread in Europe and are beginning to gain traction in the United States as a replacement for fossil fuel furnaces. However, since indoor boilers have been exempt from EPA regulation, most cord wood models are still far too polluting. Pellet boilers and furnaces using bulk pellets offer homeowners

virtually the same convenience as a fossil fuel furnace by feeding fuel automatically from a storage area. By 2014, indoor boilers and furnaces will be regulated by the EPA which will ensure that particulate levels are within set limits.

**Policy Considerations:** Once EPA establishes emission limits, there could be a flurry of programs to provide incentives to whole house systems aimed at switching all heating needs from fossil fuels to a renewable. However, due to the elevated cost associated with these units, they will require a larger financial incentive. In addition to the heating units, building the bulk fuel delivery infrastructure will also be needed.



### **Outdoor wood boilers**

(OWBs) are whole house water-heating devices that are located in small shed-like shells set away from the home. Due to the low combustion rate of these units caused by the water jacket design, most outdoor wood boilers (OWBs) that are not qualified under EPA's voluntary program are inefficient and up to 22 times more polluting than current EPA phase II wood stoves.

**Policy Considerations:** Any program that is interested in including outdoor wood boilers should only consider boilers that are qualified for the EPA's voluntary Phase II program, as well as implementing setback and stack height requirements on new installations. Even EPA phase II wood boilers are not suitable for densely inhabited areas. Energy efficiency programs should consider the additional efficiency losses in the transfer of heat from the outdoor heating unit through underground pipes to the house.

**Exempt wood stoves** are defined by the EPA as avoiding a set of characteristics, including air-to-fuel ratio, firebox volume, burn rate and maximum weight



that the EPA uses to define stoves. These stoves tend to cost \$300 - \$600, and most are made in China. EPA exempt stoves are generally sold on-line and in hardware stores, as opposed to hearth dealerships. These stoves have long posed an often unacknowledged

problem. The very substantial volume of sales of these stoves is not made public, and undermines the sales of cleaner burning EPA certified stoves.

**Policy considerations:** This class of stoves is expected to disappear in 2014 after the new EPA standards come into effect. States and jurisdictions may still want to restrict their sale and installation to avoid more installations before the new standards come into effect, as Washington did in 1997 and Oregon in March 2011.

### **Recreational Burning Devices:**



Fireplaces, and most other recreational wood burning devices are the least efficient indoor wood burning technology of all; their open design limits the user's ability to control a fire or burn at temperatures high enough to

ignite all wood combustion products. However, most fireplaces are used only occasionally, not as a source of home heating, and usually pose a smaller overall air quality problem than wood stoves.

**Policy considerations:** Fireplaces will continue to be exempt from EPA regulation, although a voluntary EPA program is being developed. Some incentive programs, such as the Arizona state program, provide incentives to replace open fireplaces with EPA certified wood stoves or certified fireplace inserts. This serves the dual purpose of helping the homeowner obtain an appliance that actually produces heat and burns cleanly, as well as inhibiting the homeowner from using the fireplace as a fireplace.



## How Will New EPA Standards Impact Incentives?

The EPA's new wood heater standards, the New Source Performance Standards, will come into effect starting in 2013, and are expected to usher in an era of cleaner wood stoves and boilers. While wood and pellet stoves will only be marginally cleaner overall, many appliances that previously were not regulated or certified, notably single burn wood stoves and indoor and outdoor boilers, will become much cleaner and more efficient. Appliances will also have to meet efficiency standards for the first time and stoves are likely to be held at least 70% efficient using the higher heating value test.

What does this mean for incentive programs? Stricter emission standards and more comprehensive coverage of appliances will likely result in more confidence in wood heating appliances. However, because the emission

| Appliance              | 1990 limit | 2014 draft proposed limit |
|------------------------|------------|---------------------------|
| Wood Stove (Non-cat)   | 7.5 g/hr   | 4.5 g/hr                  |
| Wood Stove (Catalytic) | 4.1 g/hr   | 2.5 g/hr                  |
| Pellet stove           | exempt     | 4.5 g/hr                  |
| Single rate stove      | exempt     | 3.0 g/hr                  |
| Wood boilers           | exempt     | .32 lb/MMBTU/<br>18 g/hr  |
| Forced air furnaces    | exempt     | .93 lb/MMBTU              |
| Masonry heaters        | exempt     | .32 lb/MMBTU              |
| Fireplaces             | exempt     | exempt                    |

requirements for wood and pellet stoves are only marginally stricter, incentive programs should still consider allowing only a subset of the cleanest appliances to be eligible. A three gram an hour limit on wood stoves and a two gram an hour limit on pellet stoves, or equivalent efficiency thresholds, can act as a *de facto* Energy Star designation, and steer consumers toward the most efficient appliances. In terms of boilers, new standards may open more opportunities for states to look at incentivizing boilers, particularly indoor pellet boilers with thermal storage.

## Incentive Programs Overview

Residential biomass appliance programs designed to incentivize the purchase of new biomass appliances are motivated by a number of policy goals. These policy goals can include: phasing out outdated appliances to achieve EPA air quality attainment, promoting energy efficient appliances, assisting low-income families to invest in an affordable heat source or reducing fossil fuel consumption by switching to a renewable fuel. One of the primary benefits of incentive programs is to encourage those interested in buying wood stoves to buy the cleaner burning, more efficient models, just as in the Energy Star program. The programs can provide money to either buy or to replace a current heating device. The policy motivation and available funding may determine the shape a residential wood heat funding program will take, such as: rebates, tax credits, tax exemptions, tax deductions or loans.

“States cannot expect any one of these incentives by itself to remove all the barriers to renewable energy technology development.”

- *Case Studies on the Effectiveness of State Financial Incentives for Renewable Energy*. National Renewable Energy Laboratory.

Table 1: State Incentive Programs (Alliance for Green Heat)

| Funding                | State     | Objective                          | Amount                 |
|------------------------|-----------|------------------------------------|------------------------|
| Rebate                 | <u>NH</u> | Renewable Energy/<br>Industry      | 30% to \$6,000         |
|                        | <u>VT</u> | Air Quality                        | \$1,000-<br>\$6,000    |
| Tax Credit             | <u>OR</u> | Energy Efficiency/renewable energy | 25% to \$300           |
|                        | <u>MT</u> | Renewable Energy                   | \$500                  |
| Tax Deduction          | <u>AL</u> | Renewable Energy                   | 100%                   |
|                        | <u>AZ</u> | Air Quality                        | \$500                  |
|                        | <u>ID</u> | Renewable Energy,<br>Air Quality   | \$20,000               |
| Property Tax Exemption | <u>NH</u> | Renewable Energy                   | 100%                   |
|                        | <u>NY</u> | Energy Efficiency                  | 100%                   |
|                        | <u>MT</u> | Renewable Energy                   | \$20,000               |
| Sales Tax Exemption    | <u>VA</u> | Renewable Energy                   | 100%                   |
| Low Interest Loan      | <u>ID</u> | Energy Efficiency                  | \$1,000-<br>\$15,000   |
|                        | <u>KS</u> | Energy Efficiency                  | \$20,000               |
|                        | <u>MT</u> | Renewable Energy                   | \$60,000               |
|                        | <u>NE</u> | Energy Efficiency                  | \$35,000 -<br>\$75,000 |
|                        | <u>NY</u> | Energy Efficiency                  | \$2,500-<br>\$20,000   |

## Rebates

State energy efficiency rebate programs have traditionally not included wood or pellet stoves. Primarily this is because they are not part of the Energy Star program and biomass heating appliances are not yet required to do third party efficiency testing. This will be required by 2014. New Hampshire has only statewide rebate program for new installations, and Vermont has one approved and in development. Maryland came close to passing a rebate bill in 2011. Many rebate programs used stimulus funding so it is unlikely to see another such wave of appliance rebates for some time. Rebates have been overwhelmingly used for smaller-scale changeout programs across the country, driven by air quality concerns, not renewable energy, and have often been a successful incentive type for these programs.

Rebates are lump sums of money designed to cover a portion of the purchase cost of an appliance. The rebate is either given directly by the state to the consumer upon proof of purchase or at the cash register through the retailer. Rebate sums can either be a flat rate, or a percentage of the total cost, which may be capped. The funds for rebates are often administered out of a designated pot of money generally derived from public benefits funds. The fund is usually overseen by an affiliated government agency, in the case of wood stoves, the Air Pollution Control District or state Energy Administration.

Rebates provide a finely tuned level of policy control when they are used selectively and the rebate amount is variable depending on the consumer or appliance. For example, some programs can provide greater rebates to low-income consumers, only allow consumers who have had an energy audit to be eligible, or only incentivize ultra-clean pellet systems.

## Loan Programs

Loan programs are designed to provide secure low-interest or interest free loans that are more appealing and available to the consumer than traditional loans. The state as a lender is often more forgiving of poor credit history and can make loans to cash-challenged customers who can neither purchase a system outright nor secure a loan from a traditional lending institute. Loan interest ranges from 1-6%, and repayment terms range from three to twenty years. There has historically been a larger percentage of loan programs for wood heat than either grant or tax credit programs, and many loan programs have an unprecedented longevity. Several loan programs, such as the Nebraska, Idaho and Connecticut state programs, have been in operation for over 20 years, primarily due to the loan investment returning to the fund. Unfortunately few have kept accurate records about how many loans were given for biomass appliances. State loan programs are funded through a number of different means including revolving loan funds created with the petroleum violation escrow funds (also known as “oil overcharge” funds), air-quality noncompliance fees, bond sales, annual appropriations or public benefit funds.

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“With this program, the state gets its money back and helps homeowners lower their energy costs.”  
-Ernesto Guardardo, *The Connecticut Energy Conservation Loan Program*

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All but one of the loan programs for wood heat has an energy efficiency goal as opposed to a renewable energy goal. Loan programs can be useful to many low-income consumers, however some will still not be able to take advantage of this rebate type due to too poor of credit and would benefit more from an alternate incentive type. Most programs covered stoves but not necessarily boilers. Uncertified outdoor wood boilers were theoretically covered by one of the state loan programs.

| Strengths   | Weaknesses   | Recommendations   | I | Strengths   | Weaknesses   | Recommendations  |
|---|--|---|---|---|--|--|
| <p><b>Supports Market Transformation:</b> The rebate provides one of the most direct and powerful means to influence consumers and drive market demand and bring down costs over time. It is also the best incentive for middle income consumers.</p> | <p><b>Funding/cost:</b> This is a difficult time to add a technology to rebate programs, despite how worthy they may be. Absent Energy Star designation or other accepted standards, it is difficult for states to create eligibility criteria, even with the advent of pellet stove technology.</p> | <p><b>Inclusion:</b> Cost of including the highest efficiency biomass appliances could be offset by limiting eligibility to families with household income under \$200,000, capping all renewables at \$7,500 or limiting biomass program to families with very low household income.</p> |   | <p><b>Sustainable:</b> When loans are given for biomass appliances that have a proven short payback period, the loan fund becomes self-sustaining as the initial investment is returned by the homeowner to be reinvested in other homes.</p> | <p><b>Not a significant incentive for less-expensive systems:</b> For stoves costing a few thousand dollars, a loan program may not be as tempting of an incentive as an upfront rebate.</p> | <p>Calculate the potential cost savings on a case-by-case basis to ensure switching from the existing system to a particular biomass system is worth the financial investment. Only make cleanest appliances eligible.</p> |

## Tax Incentives

Tax incentives are a popular method for all levels of government to fund wood stove programs. These programs do not require an upfront cost or a direct source of funding, but do take away future revenue. Additionally, a drawback all tax incentive programs share is that they are of little use to low-income households that pay little if any taxes. If a program goal is to address low-income needs or include low income families, tax incentives are not effective.

**Tax credits** are a set dollar amount that can be applied to State or Federal Taxes and used towards income or property taxes. Tax Credits are the most valuable end-of-year benefit, because they directly reduce the amount of taxes owed dollar for dollar. The Oregon Residential Energy Tax Credit incentivizes stoves that meet the strict state emission standards of under 4.5 grams/hour (g/hr) for wood stoves and under 2.5 g/h for pellet stoves. The Montana tax credit program was originally designed to address non-attainment issues and has given over \$700,000 in tax credits since its inception, with around half of the applications for wood stoves. Roughly 1,400 wood stoves have been financed by this program.

**A tax credit of \$500 for someone in the 28% tax bracket is equivalent to a tax deduction of \$1,700.**

**Tax deductions** are subtracted from taxable income and reflect an expense. They are only valuable to the consumer if they itemize their deductions instead of taking the standard deduction. If itemized, a deduction is generally worth about 28 percent for many households; less for lower tax brackets and more for higher tax brackets. The Idaho program was established in 1995 and provides a 100% tax deduction to replace uncertified stoves with pellet or EPA certified stoves. In 15 years, over 3,800 people have

claimed the deduction. This is a very high number of stoves replaced for a tax program, so this is considered to be a very successful and cost-effective program.

**Property tax exemptions** are applied for the value of renewable energy systems. Generally either the assessed value of the biomass heating system or the cost of purchase and installation are exempted from the property taxes. Since this incentive is only accessible to those who own the property, it is not a helpful incentive when addressing the needs of renters. In the US, 13% of wood burners rent their homes. The Montana Property Tax Deduction has rarely been claimed by residents since generally the small scale residential stoves are not even assessed for their value in most counties, so people do not need to apply for the property tax exemption. Property tax exemptions are rarely utilized by the homeowner, and it is unlikely that they act to incentivize new stove purchases. As a relatively small incentive, it is possible that property-tax exemptions need to be bundled with other incentive programs to be significant, and instead serve more as a signal of support for the technology.

**Sales tax exemptions** are an upfront discount on the purchase price of a biomass thermal system. In the case of the larger biomass boiler systems, this exemption could be significant. Virginia has a sales tax exemption for biomass heating appliances, and there have been similar exemptions for other renewable energy technologies in other states. This incentive could be significant for the more expensive whole house heating systems where an exemption from a 6% sales tax on a \$20,000 system yields \$1,200 in savings. A simple policy fix in many states of adding biomass heating systems to the existing laws would be a straightforward method of reducing the disparity in renewable energy incentives.

### Evaluation and monitoring

As with solar and other renewable incentive programs, residential biomass heating programs can help contribute to the growing base of knowledge about performance issues by conducting performance monitoring and post-installation inspections. Consumers have substantial financial motivation to ensure that their appliance operates efficiently and provides the expected savings. However, there is often lack of awareness of the financial ramifications of potential performance issues and a lack of the knowledge and means to address these issues. Incentive programs can leverage financial incentives by helping customers become more educated owners and operators of biomass appliances.

State and local building codes go a long way towards ensuring that biomass systems function safely and reliably. However, these codes are not always followed or effectively enforced, as building inspectors and installers may lack a solid understanding of standards. Incentive programs can improve the effectiveness of these codes by directly verifying compliance, requiring a sign-off by the building inspector prior to paying the rebate, sponsoring training of local installers and building inspectors, and/or by requiring that installers meet minimum hearth training requirements. Acceptance testing involves spot measurements to verify that the stove or boiler is functioning properly and producing heat at the expected level.

## Changeout programs

A wood stove changeout program is a campaign to replace high-particulate emitting old stoves, with new cleaner-burning units. Policy goals include: reducing air pollution caused by wood smoke, assisting low-income households to afford a more efficient heating source and removing unsafe older stoves from circulation. The majority of changeout programs require proof of destruction and/or recycling of the old heating unit; the responsibility of proof is sometimes put upon the retailer or can be a certification from the local recycling program.

Financing programs on the state level generally take the form of rebates. On the local level, financing is almost always rebates or grants. Two on-going statewide programs rely on the somewhat weaker incentive of a tax deduction. Funding is often supplied by a combination of state, federal, and industry groups like the Hearth, Patio and Barbeque Association (HPBA) or smaller wood stove retailers. Program designers should consider settlement agreement project, both SEPs and mitigation projects, which are more flexible as a way to fund their programs

**Education on clean burning practices and outreach is paramount to the success of any changeout program. Without these components, poor burning practices can persist despite the new appliances.**

Wood stoves have traditionally had extremely long lifespans; often they remain in use for 30 – 50 years. As a result, the majority of wood stoves in the US are still not EPA certified, although the certification program began in 1988. Pollution from older or exempt stoves can be a serious health concern, and one of the best ways to remove them from circulation is a changeout program. Changeout programs can be carefully designed to meet a wide variety of policy goals, such as the Klamath Falls Oregon program which provides a 100% benefit to low-income families.

**Crucial Resources**

**Burn Wise**

<http://www.epa.gov/burnwise/how-to-guide.html>

**wood stove CHANGEOUT**

<http://woodstovechangeout.org/index.php>

Many changeout programs have to overcome a barrier of time between the first-adopters and those who wait a while to determine if the program was too good to be true. In shorter term programs, if this gap-time falls towards the end of the program time-frame, a large segment of interested stove owners miss their opportunity.

The second major challenge incentive programs face is determining the correct percentage of total cost to cover. If the percentage is too high, the program runs out of funds before it runs out of applicants, if the percentage is too low, there is not enough interest in the program to utilize the funds. One solution is to initiate a short term pilot program to gauge participation and explore the optimal funding amount. The very low-income households will always require 80-100% of the total cost to be covered, as there is little to no disposable income. A small level of payment is often necessary however to encourage buy-in, but in some cases the administrative cost of collecting this sum may not outweigh the benefits of increased low-income household buy-in.

A key tradeoff for an area facing the need for significant changeouts, a Federal PM 2.5 non-attainment area for instance, is the value of a prohibition on use of old stoves after a certain date. This involves enforcement and should not be undertaken lightly, but it does potentially lower the required incentive amount. Conversely, if the local community has no restrictions on usage, either on no-burn nights, or restrictions on building permits, old stoves will be more expensive to eradicate from the community.

| Strengths  | Weaknesses  | Recommendations  |
|--|---|--|
| <p><b>Improves air quality:</b> The Libby Montana changeout program demonstrated that removing high polluting stoves has the potential to significantly improve an airshed, and indoor air quality.</p> <p><b>Politically attractive:</b> Instead of banning use of polluting appliances outright, providing a cash incentive to upgrade is best and can be coupled with a future sunset clause on old appliances.</p> | <p><b>Requires a large incentive:</b> Unlike programs offering money to install a first time system, changeouts attempt to entice people to exchange what may be a functional heating device with a new purchase. Because of this, a substantial incentive must be offered if the target is lower income households or the program is operating in an economically stressed time.</p> | <p><b>Ban future installation of polluting devices:</b> Many changeout programs have been undermined by allowing the same type of stoves that are changed out, to be installed, thus perpetuating the need for tax-payer funded changeouts. The Great Lakes region subsidized changing out old stoves while allowing unregulated outdoor wood boilers to be installed. In Vermont, second hand stoves from the 1960s can still be installed.</p> |

## Other Programs

**Renewable portfolio standards** (RPSs) set requirements for the amount of renewable energy or renewable energy credits that utility companies must use by a specific deadline. Most states either have RPSs or at least non-binding renewable energy goals. A few states have provisions for customer-sited renewable use, or even requirements that a portion of the renewables come from customers. So far none of the eligible residential technologies include wood or pellet stoves. The argument made against including wood/pellet stoves is that it is too difficult to determine the precise amount of electricity displaced by the appliances producing thermal energy. However, some state programs do include geothermal which presents the same challenge in tracking electricity displacement as biomass stoves. These states could benefit if they counted the contributions of biomass stoves as a source of renewable energy, so should consider including residential wood heat.

**Green Building Standards** are a significant way to incentivize certain technologies and heating systems. The LEED program is the most prominent national program, but its point system deals with biomass systems in the indoor air quality section, instead of as a renewable energy source. It simultaneously rewards installing an *approved* biomass appliances adhering to certain specifications, or not installing *any* biomass appliance. European green building standards have more experience with more sophisticated biomass heating systems and can provide an important precedent and examples of standards for LEED and other green building certification programs.

**Weatherization Assistance Programs** (WAP) are offered by virtually every state and provide a key and relatively easy way for states to help low-income families better use wood heat. However, the framework for wood stoves in these programs could do much more to recognize the role of wood stoves as renewable energy equipment and as a way to reduce reliance on fossil fuel heating assistance. Most state programs include the repair and/or replacement of wood stoves. Some states such as New Mexico, limit repairs and replacement to homes where a wood stove in the primary source of heat. California allows replacement only if the existing unit is a safety hazard, or the absence of the unit would be harmful

**Fuel incentives** come in two general forms: tax incentives or affordable wood harvesting permits. Tax incentives are generally offered in the form of tax exemptions or credits and can be applied at the production, sale or use of fuels. Missouri offers an energy production tax credit for pellet production. Maryland, Georgia, Wisconsin and Virginia all offer sales tax exemptions on heating fuel including wood or pellets. These are valuable tax

exemptions for small wood fuel businesses who are relieved of tax filings and paperwork. Tax exemptions can also act to signal governmental support for a renewable fuel which has to compete against heavily subsidized fossil fuels. Any existing sales tax exemptions for heating fuels should be amended to include wood fuels.



National Forests and many state forests, allow homeowners to cut their own wood for as little as \$10 per cord. In 1982 the Forest Service issued 655,000 permits to cut firewood on national forest land. Managers estimate that 2.8 million cords were cut, about 5% of all cord wood harvested that year. This shows an extraordinary demand for firewood that is still little understood or appreciated. The self-harvest programs on government lands are excellent for low-income consumers who do not own land and may not otherwise have access to affordable wood. An additional benefit of these programs is that they can provide a valuable tree thinning service to state and federal land management agencies.

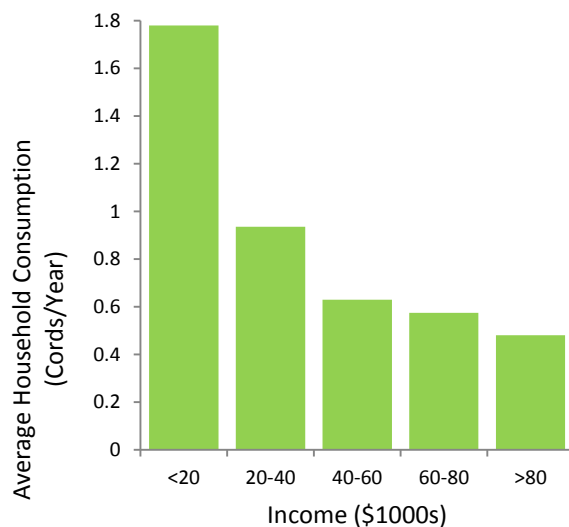


Figure 10: Cordwood Consumption by Income in the Southeastern U.S. (The Gallup Organization)

## Federal Programs

The Federal Government has few policies or programs on residential wood heat. The EPA Office of Air Quality Planning designs incremental emission level improvements instead of helping to develop an overall strategy to deploy the cleanest appliances, as many European agencies do. The DOE tracks wood heat but has no programs to incentivize it as they do for other forms of biomass. DOE also has robust programs for other renewable energy technologies like solar and geothermal, which goes towards wealthier families. USDA is the sector's most natural home and has considerable expertise and understanding, but most funds still go to biofuels.

**Individual tax credit (Tax Code Section 25c)** has provided wood and pellet stoves with a tax credit since 2008, although it has been lowered as of December 31, 2010 to 10% with a \$300 cap. The \$500 tax credit (only \$300 allowed for heating appliances) is a lifetime maximum, meaning that if a homeowner has used this credit anytime since 2005, it cannot be used again. During 2009-2010, the 30% credit up to \$1,500 could be used regardless of whether the family has used the credit before. Although this was a significant incentive, it came during a period of recession and did not result in as high a number of sales otherwise possible. Some experts recommended an additional credit to also remove older stoves. Experts also criticized the program for allowing manufacturers to claim the required 75% efficiency with little or no oversight. All manufacturers claimed that virtually all certified stoves were also 75% efficient. The program had no emissions cap and missed the opportunity to only incentivize the cleanest burning and most efficient models.

| Strengths   | Weaknesses  | Recommendations   |
|---|---|---|
| Recognized wood/pellet stoves for the first time in a national energy efficiency incentive program. | Did not incentivize the top percentage of the market in efficiency or in particulate emissions. | High efficiency wood and pellet appliances should be included in Section 25D, the renewable energy technologies tax code. |

**Low Income Energy Assistance Program (LIHEAP)** is a federally funded block grant program that is implemented at the State and Tribal levels to assist low-income households with energy bills. The program includes wood and pellets among eligible fuel sources but often gives it a smaller benefit, leading many families to collect the higher amount for fossil fuel heat. LIHEAP will also repair or replace wood stoves that are broken beyond repair. An innovative Montana program found that replacing an inefficient wood stove with a new efficient unit, was a cost effective way to use LIHEAP funds. All state

LIHEAP program should integrate wood stove changeouts for families who heat with wood. The Department of Health and Human Services that oversees LIHEAP funds should also work with the Sustainable Communities initiative and other programs, to direct and urge states to use LIHEAP funds to help families reduce fossil fuel use.

| Strengths  | Weaknesses  | Recommendations  |
|--|---|--|
| One of the only programs that provides funds to repair or replace stoves in low-income households. | Individuals and small businesses are not as well equipped to handle the administrative and fiscal hurdles as large fossil fuel suppliers are. | States should more aggressively use LIHEAP funds to provide new, EPA certified stoves to any family receiving LIHEAP funds already using wood. |

**Property-Assessed Clean Energy (PACE)** programs were promoted by the DOE and many states were passing enabling legislation until federal housing loan agencies put a virtual stop to the programs. Property-Assessed Clean Energy (PACE) financing loans allowed property owners to finance renewable and energy efficiency. The loans would have funded projects as diverse as insulation, energy efficient boilers (including biomass), new windows, and solar installations, and were to be repaid over a 20 year period via property tax assessments.

| Strengths  | Weaknesses   | Recommendations   |
|--|--|---|
| Attached loan payments to the property tax, loan remained with the home when sold. | Fannie Mae and Freddie Mac did not want an energy-related lien to be senior to a mortgage. | PACE loans would be ideal to fund larger, whole house biomass heating systems. If PACE re-emerges, states should identify which biomass systems are eligible. |

**Home Star** could have provided a boost to thermal biomass but did not pass Congress, and appears increasingly unlikely to be implemented in the foreseeable future. The Home Star Energy Retrofit Act of 2010 (H.R. 5019), would have given a \$1,000 rebate for stoves with 75% thermal efficiency that meet 75% of a home's heating needs and emit less than 3 grams of particulates per hour. For a wood stove to qualify, the homeowner would have had to trade in an existing wood stove, but a pellet stove would have qualified without any changeout requirement.

| Strengths   | Weaknesses   | Recommendations   |
|---|--|---|
| Would have been the first national changeout program and could have taken thousands of polluting stoves out of circulation. | The program had many requirements and sought to achieve many policy goals. It was likely to be somewhat confusing for consumers. | If the program is resurrected, the biomass provisions should be streamlined and the emissions and efficiency standards updated. |

## European Programs

Many countries throughout Europe have experienced a substantial increase in residential wood heating—especially in the form of ultra-clean pellet stoves and boilers—due to strict policy measures combined with generous incentives. This has allowed for more widespread adoption and technological advancement of biomass appliances than is currently being realized in the United States.

In many cases the motivation is to reduce CO<sub>2</sub> emissions and to meet renewable energy targets, but in many countries with abundant biomass resources, incentives are put into place in order to stimulate job growth. This has largely been the case in Upper Austria—a state about the size of New Hampshire—where consumers can take advantage of multiple incentives to purchase pellet boilers. The manufacturing of these boilers and the fuel distribution network, in turn, supports 4,500 jobs in the region. Often, incentive programs are implemented in tandem with regulatory policies that progressively tighten emission limits and efficiency requirements over time. The result is stronger investment in biomass boilers that are both cleaner and more efficient (Fig. 12).

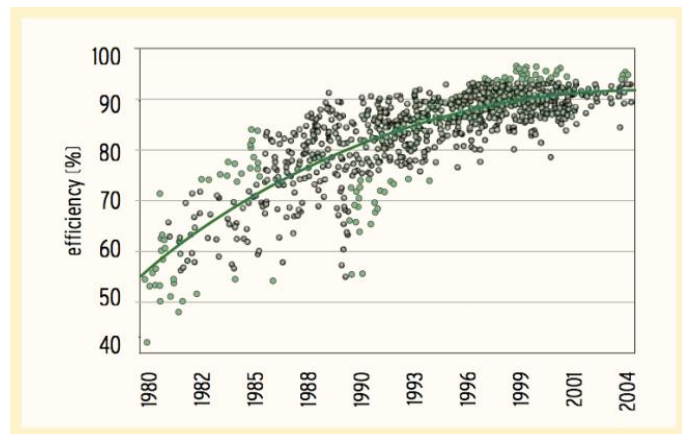


Figure 12: Efficiency of Individual Boilers Increasing due to Incentives. While boiler efficiencies have stagnated in the U.S. European Incentive Programs have driven efficiency improvements. (Biomass Heating in Upper Austria)

One reason that many European countries provide such strong incentives for home biomass heating is that they are mandated to increase their renewable energy production under a directive from the European Union Parliament. This requirement is similar to the U.S. State Renewable Portfolio Standards. The European mandates, however, are much more far reaching, requiring each nation within the European Union to commit to the directive by

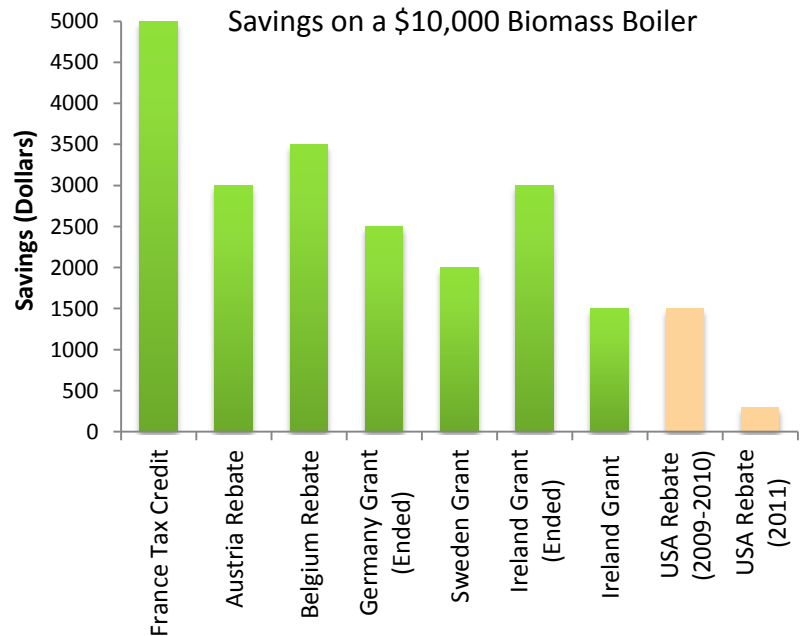


Figure 11: Savings on a \$10,000 Biomass Appliance -stoves, masonry stoves, boilers, etc. (International Energy Association)

Public information and education campaigns are also used to reinforce these positive trends.

drafting Energy Actions Plans. Unlike many Renewable Portfolio Standards in the United States which typically only target electricity production, the European standards have provisions for renewable heating. The result is that many European nations have sought to reach their renewable energy targets by incentivizing biomass appliances.

The success that many of these programs have realized in terms of growing the market for the cleanest, most efficient biomass heating systems is well documented. It also offers a good example of the effect that well crafted incentive programs can have. The Market Stimulation Program in Germany, for example, uses both grants and loans, which are flexible so that they can be adjusted according to budget constraints or to maintain program goals. Additional grants and bonuses are even provided for more innovative technologies such as secondary emission reduction devices. If a stove or boiler does not meet certain standards for efficiency and emissions, the government will not offer a subsidy.

In 2011, the UK launched the world's first Renewable Heat Incentive Program to revolutionize the way heat is generated and used in buildings and homes. Included in this is a thermal feed-in program paying tariffs to residential consumers and 25,000 residential projects are eligible for Premium Payments to help cover the upfront costs.

**About this Report:** This year-long project, partially funded by the US Forest Service Wood Education and Resource Center, explores the existing and potential policy options for incentivizing more efficient and clean burning residential wood heat. The project involved intensive stakeholder consultations with industry, non-profits and government. A primary goal was to explore how to increase the ability of Americans of all socio-economic groups to use wood heat and reduce reliance on fossil fuels. The full version of the report can be found at [www.forgreenheat.org/resources/toolkit](http://www.forgreenheat.org/resources/toolkit). The report was written by John Ackerly and Tatiana Butler of the Alliance for Green Heat with the assistance of the Wood Heat Task Force (see below). Many thanks to Alliance research fellows: Keith Krosinsky, Elizabeth Klusinske and Jordan Townsend.

**Alliance for Green Heat:** The Alliance for Green Heat promotes high-efficiency wood combustion as a low-carbon, sustainable, local and affordable heating solution. The Alliance for Green Heat educates the public, the media and local, state and national policymakers about the potential of wood and pellet heat and its applications to low and middle-income populations. The Alliance is an independent non-profit organization and is tax-exempt under section 501c3 of the tax code.

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