

# Wood and Pellet Burning Program Feasibility Study for Wisconsin

August 6, 2008

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*This report is the property of the Public Service Commission of Wisconsin, and was funded through the Focus on Energy Program.*

### Introduction

This study summarizes research related to the potential for wood and pellet furnaces and stoves to reduce fossil fuel usage in Wisconsin. National recognition of significant increases in electricity and gas costs to homeowners has prompted renewed interest in investigating options for heating homes in more cost effective and environmentally friendly ways. Focus on Energy (Focus) is interested in understanding the feasibility of developing a program to increase the penetration of wood- and pellet-burning appliances in Wisconsin. In 2007 Focus on Energy (Focus) commissioned a study of the feasibility of burning corn in homes: "Corn Furnace Program Feasibility Study for Wisconsin." The report on that work is available on the Focus on Energy website. This research is a follow-up to that earlier work.

### Methodology

A variety of approaches were used to obtain the information summarized in this report. Interviews were conducted with all of the industry stakeholder groups – from manufacturers, appliance and fuel dealers and manufacturers, government agencies, industry groups, consultants, and, of course, homeowners who have installed wood and pellet burning appliances.

The study also includes review of outside wood boilers for heating homes.

### Findings

This study was charged with summarizing findings relative to three issues:

- A profile of wood and pellet burning appliances and fuels available in Wisconsin
- The net impact of wood- and pellet-burning on household electric and natural gas use
- The feasibility of a Focus on Energy initiative to promote use of biomass appliances

Key findings are summarized below with more detailed discussion in the next section of this report.

With respect to the current market for biomass appliances:

- The biomass appliance market in Wisconsin is a significant proportion of Wisconsin's overall residential space heating market with approximately 10,000 to 20,000 units to be sold in 2008
- A typical biomass installation is one where the appliance supplements (rather than replaces) a fossil fuel heating system.
- Appliance overall efficiencies vary depending on the type of appliance being installed. Approximate efficiencies are:
  - Certified wood stoves = 78%
  - Certified pellet stoves = 78%
  - Cordwood furnaces = 70%

- Pellet furnaces = 80%
- Orange Tag certified Outdoor wood boilers = 70%
- The cost of both cordwood and pellets has increased about 14% over last year - to about \$187/cord for wood and \$205/ton for pellets this year.
- The equipment and accessories to burn biomass are readily available from manufacturers and dealerships that sell biomass appliances – but there are backlogs.
- Both wood and pellets are abundantly available for purchase throughout the state, with adequate supplies available for several years to come. But increasing demands for wood residues may challenge price-points in the future.
- Wood and pellet furnaces cost on average about \$5,100 and \$5,600 respectively to install while stoves are less expensive at about \$3,100 and \$3,300 respectively.
- While emissions data for fossil fuel burning is easily available, the necessary emissions data for wood burning are not available. Also, there is no consensus on what the net carbon dioxide equivalent emissions are for burning biomass. As a result, it is difficult to compare emissions from burning biomass to burning natural gas at this time.

With respect to potential energy savings:

- Wood and pellet fueled appliances are cost effective in select situations, such as:
  - when displacing LP gas or heating oil
  - when the heating use of natural gas is high (as in older, less efficient homes) and cordwood stoves are considered
  - when the homeowner can acquire wood heat cheaply or free
- The natural gas consumption of a typical older existing home with an atmospheric furnace may be reduced by about 896 therms with a savings of \$193 per year through use of a **wood-burning furnace**. However, use of a pellet furnace would cost the homeowner about \$2 more per year
- The natural gas consumption of a typical older existing home with an atmospheric furnace may be reduced by about 762 therms with a savings of \$351 per year through use of a **wood-burning stove**. And, use of a pellet stove would save the homeowner about \$178 more per year where some zoning is practiced
- Biomass stoves are more cost effective than biomass furnaces due to their lower cost
- The long term cost effectiveness of wood and pellet stoves and furnaces is likely to remain the same, as fossil fuels will likely escalate at a faster pace in the future.

With respect to the feasibility of a Focus initiative to promote biomass burning in homes, it is important to note that Focus is funded through a surcharge on electric and natural gas rates and is charged with reducing electric and natural gas usage, not LPG usage.<sup>1</sup> That said – the Focus eligible customers best suited for this technology are those who have high natural gas heating bills. This would include older homes that are large, not well insulated and leaky, and where the homeowner burns wood rather than pellets. The program feasibility Total Resource Cost (TRC) test results are too low and the payback is

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<sup>1</sup> Historically Focus has supported measures that reduce LPG usage (because it was assumed that reduced LPG usage would ultimately reduce natural gas costs) but it is not clear that this policy will continue in the future under the new funding mechanism. This analysis focuses on the feasibility of reducing natural gas usage rather than LPG usage.

too long for homes using less heating energy.

The following table summarizes the results of evaluating the cost-effectiveness of several installation options for biomass appliances. The TRC measures cost-effectiveness from a total program and customer cost perspective, while payback is a simple measure of cost-effectiveness from the customer's perspective.<sup>2</sup>

Scenario:	Natural Gas <sup>3</sup>	
	TRC (B/C Ratio)	Customer Payback (Years)
Wood stove (Existing Home with 80% AFUE furnace)	0.83	4
Wood furnace (Existing Home with 80% AFUE furnace)	0.84	13
Wood outside boiler (Existing Home with 80% AFUE furnace)	NA	18
Wood stove w/free wood (Existing Home with 80% Furnace)	2.68	2
Pellet stove (Existing Home with 80% AFUE furnace)	0.71	9
Pellet furnace (Existing Home with 80% AFUE furnace)	0.66	-1,364

This table shows that only the situations where the customer can acquire free (or near free) firewood passes the Focus TRC test. That being said, the customer payback periods are 15 years or less (passing criteria) for all but two scenarios: burning pellets in a furnace or burning wood in an outside boiler.

The outside wood boiler scenario requires some further discussion. The high cost and low efficiency of the “system” limits its value where natural gas is available. Also, the analysis done assumes that only Orange Tag certified boilers (discussed in the report) are eligible for the program – so that the program does not contribute to the often local pollution problems created by the ineffective use of this technology. The “NA” in the TRC column is a result of our not running the TRC test because it is obvious from running this technology for the case where LPG is the base-case fuel. Given that the cost per million BTU for LPG is more than twice the cost of natural gas, and that this technology did not fare well in the TRC tests using LPG, we saw no reason to run the natural gas situation through the test.

## Recommendations

If Focus on Energy were to decide to promote biomass burning appliances, it is reasonable that the program be an information only initiative that would help homeowners understand the pros and cons of installing biomass furnaces and stoves and easily assess whether this technology meets their needs. It should be noted, though, that the manufacturers and dealers are already doing successful consumer education in limited markets. If Focus becomes involved, it should do this in cooperation with the industry actors. Otherwise Focus might interfere with the existing success and possibly reduce the

<sup>2</sup> A few more scenarios are discussed in the report and the technical supplement.

<sup>3</sup> Passing the TRC test requires the benefit-cost ratio to be >1.00.

long-term market share for biomass appliances, thereby losing the economic and environmental benefits inherent in this technology. Focus should commit to increasing the market share for biomass burning in homes in the long term or not include this technology in its menu of programs.

It is notable that two of the dealers we interviewed stated, without prompting, that Focus should not provide incentives for biomass appliances during the upcoming (2008-2009) heating season. The demand currently outstrips the supply and incentives would likely support non-committed sellers of appliances who will not be around to support customers' appliance and fuel needs in the future.

These findings and recommendations are discussed in more detail in this report and technical supplement.

## **Background**

The accelerated inflation of fossil fuel costs in the last few years has resulted in many homeowners looking for ways to cut their home heating costs. One of the obvious options is to improve the efficiency of their homes. Another is to investigate using less expensive renewable energy for heating their homes. Wood- and pellet-burning in stoves and furnaces are increasingly popular renewable energy options.

Consistent with the scope of work, this study is organized into three sections. The first is a profile of the wood and pellet appliance and fuel markets. The second discusses the energy and environmental impacts of wood- and pellet-burning for heating homes. The final section discusses the feasibility of Focus promoting wood and pellet stoves and furnaces as part of its efforts. This includes recommendations for program design if one is added to the Focus program menu. This report also references a more robust discussion, the Wood and Pellet Burning Program Feasibility Report Tech Supplement, which provides more: market discussion, technical information about some of the calculations used in this study, and program options discussion.

## **Wood and Pellets Fuel and Appliance Markets**

It is important to understand the cordwood and pellet commodity and appliance markets in the context of the potential for developing a program to increase the penetration of these biomass-burning technologies. The potential of wood and pellet burning appliances for displacing natural gas for heating homes is another important and related issue.

### ***Wood and Pellet Markets***

There are four primary sources of wood that is used either directly for burning in home appliances or indirectly through production of pellets for burning.

1. Furniture and flooring manufacturing scrap
2. Sawdust and residuals from sawmills
3. Urban tree removal (UTR)
4. Logging and forest management residuals

Firewood and pellet companies draw from each of the sources – and often compete with other industries having other uses for the wood. For example, mulch is in increasing demand by landscaping companies. And the building products industry has increased their need for wood chips with the growth in the use of oriented strand board in constructing houses.

Most forestry and ecology professionals believe there is still adequate supply of woody

biomass to support significant increases in wood-residue heating of homes. However, some suggest that in time there will be at least a potential “peak-wood” situation that at a minimum will drive the price of wood-residue for home heating beyond economic means. That is, there is a possible situation where other demands for wood residues will drive the market and raise the price of wood higher. One agricultural ecologist we spoke with suggests that we “can’t afford to trade peak oil for peak soil.”

Of the fifty states, Wisconsin ranks among the highest in its potential to produce forest biomass for bio-energy. And, although the acreage of forested land (16 million acres) and the amount of growing stock are increasing the state faces a potential forest-biomass supply shortage. The problem is one of accessibility of supply.

When demand increases faster than the current supply, the cost of biomass increases - and available supply is a function of the price of the residues. An example of this is shown in the following table – for delivered prices<sup>4</sup>.

Biomass Feedstock Availability for Wisconsin - 1999			
	<\$30/dry ton	<\$40/dry ton	<\$50/dry ton
Forest Residues	609,000	886,000	1,138,400
Mill Residues	42,000	1,202,000	1,892,000
Urban Wood Waste	639,110	639,110	639,110

There is increasing competition for wood residues that can be used for heating. Some of these competitors for fuel are changing the markets and will likely put upward price pressures in the near-term.

Competitors for wood residues include:

1. Firewood distributors
2. Pellet manufacturers
3. Industrial Uses
4. Landscaping companies
5. Oriented strand board and compressed wood manufacturers
6. Bio-fuels, and others.

Higher prices of primarily heating oil and propane are increasing the demand on the biomass available in the state. This will, in turn, result in higher cost of the resources and allow more of them to be cost-effectively harvested.

There generally is consensus that for the foreseeable future there is adequate supply available for the growing biomass-for-energy needs. And, that the prices will not track the inflation of fossil fuels in the near term.

### **Wood and Pellet Prices**

<sup>4</sup> Biomass Feedstock Availability in the U.S.: 1999 State Level; Walsh, Marie E., et. al.

The prices for wood and pellets have historically tracked general inflation. But of course the cost of energy in general tracked general inflation closer than in the last few years – and it now drives increases in overall inflation.

Given the current accessible supply of biomass, it is reasonable to assume that inflation of biomass for energy will not, in the short term, track the supply constrained fossil fuels tightly.

However, in the past year we have found that the cost of biomass fuels have tracked natural gas closely and lagged considerably below the costs of LPG and heating oil.

The cost of natural gas increased in the last year from about \$1.10/therm to \$1.25/therm – a 14% increase. The cost of cordwood increased from about \$170/cord to \$187/cord – a 10% increase. The cost of pellets increased from about \$180/ton to \$205/ton – a 14% increase.

On the other hand, the cost of propane increased in the last year from about \$1.65/gallon to \$2.33/gallon – a 41% increase. And the cost of heating oil increased in the last year from about \$2.36/gallon to \$3.72/gallon – a 57% increase.

These changes are reflected in the customer payback periods and TRC results for the fuel switching scenarios looked at in this study.

### ***Biomass Burning Appliances***

The sales of biomass appliances are moving in contrary directions. Both the long-term and short-term direction of sales of wood-burning appliances is down for a variety of reasons – but mostly convenience. On the other hand, the trend for sales of pellet-burning appliances is up. And the curve is steeper in the last few years – driven by the continued significant increase in the costs of fossil fuels.

While the trend for wood burning appliances is downward, the number of wood burning units sold still far exceeds sales of pellet-burning units. We estimate that about 8,000 to 15,000 wood burning stoves, fireplaces, and furnaces (including boilers) will be sold in Wisconsin this year. In addition, we estimate that 3,000 to 6,000 thousand pellet appliances will be sold.

In general most of the biomass units being sold recently are stoves, where we estimate this to be 80% to 90% of the marked for wood and pellet appliances.

The Potential Study conducted by Focus a couple of years ago suggests annual sales of natural gas furnaces in Wisconsin of about 90,000 units per year. Thus biomass appliances likely make up 10% to 20% of the heating systems sold for homes.

Wood and pellet furnaces cost on average about \$5,100 and \$5,600 respectively to install. Pellets furnaces cost more because their construction is more complex. However,

this complexity provides more convenience (feeding system) and higher efficiency. These costs are based on a typical flue pipe installation – there are situations where the cost could be another \$1,000 or more when the flue installation is complicated by particulars of the house. This hold true for stoves and inserts as well.

In the situation where the existing fossil fuel furnace is over 20 years old, the cost of the biomass furnace could be discounted to about half the investment cost because replacement of the fossil fuel furnace would be delayed significantly. Under this scenario, the incremental cost of the furnace would be considered about \$2,550 or \$2,800.

Stoves are less expensive to install at about \$3,100 (wood) and \$3,300 (pellet) on average. Again, pellet stoves are a little more expensive than wood stoves for similar reasons.

We did not do analysis of the payback and B/C tests for installing fireplace inserts because they are similar to stoves and our time was limited. However, we did find that installing fireplace inserts are slightly more costly than installing stoves - at about \$3,400 on average. This is primarily due to lower volume sales and the potential for more complex venting system installations of existing fireplaces.

Of interest is the evolution of the non-cordwood biomass appliance market from single-fuel to multi-fuel units. While individual pellet or corn stoves can still be purchased, the manufacturers continue to move to multi-fuel appliances that can burn corn, pellets, cherry pits, and a variety of other residual biomass products.

Finally it is important to note that biomass burning appliances require more maintenance from homeowners than do their fossil fuel counterparts. Homeowners with a natural gas furnace are responsible for occasionally changing the filter while homeowners with a biomass burning furnace or stove need to empty ashes, haul fuel to the stove or furnace and perform other maintenance tasks on a regular basis. While these tasks are not insurmountable, some biomass appliance sales staffs point this out to make the point that this technology is not suitable for everyone.

A variety of other biomass appliance and cost scenarios are discussed in the [Wood and Pellet Burning Program Feasibility Report Tech Supplement](#).

## **Energy and Environmental Impacts of Biomass Burning for Heating Homes**

Focus' interest in the feasibility of biomass burning for heating is premised on its charge to reduce electric and natural gas consumption and the environmental impacts associated with that energy usage. Burning biomass to heat homes potentially provides benefits to the Focus on Energy program.

### ***Energy and Energy Cost Savings***

The natural or LP gas energy savings from biomass burning for heating homes is significant. However, while there are significant energy cost savings from displacing LP gas, the cost savings from displacing natural gas are limited. The difference is driven by the costs of the fuels.<sup>5</sup> These savings differences result in divergent payback periods from biomass burning.

For an existing home that has significant current natural gas use, using a biomass burning furnace might displace about 896 therms per year. The same home that is currently using LP gas might see a displacement of about 979 gallons per year. Efficient and new homes that have lower heating loads will have less energy savings.

Given usage reductions and fuel costs, it is easy to understand why homes that burn LP gas are a better candidate for biomass-burning furnaces and stoves. (In both cases the savings above are based on the home having an 80% efficient atmospheric furnace.) An existing home using natural gas and reducing usage by 896 therms per year will save about \$193 per year if the cordwood costs \$187 per cord. A similar home using LP gas and saving 979 gallons per year will save about \$1,646 per year in heating costs. The payback period for displacing natural gas heat by burning wood, where the existing furnace is older, will be in the order of *thirteen* years ( $\$2,550/\$193$ ). For the same home where LP gas is being displaced the payback period will be about *two* years ( $\$2,550/\$1,646$ ). Where the home is new or small and efficient the payback period basically triples in each case – 40 years where displacing natural gas and five years where displacing LP gas.

The analysis also assumes an average annual efficiency of wood-burning furnaces and outside boilers to be about 70% and 80% (AFUE equivalent) respectively. These are weak estimates based on researcher and manufacturer-published efficiencies. There has yet been no standardized measurement of wood-burning furnace or boiler efficiencies. The assumed efficiency of pellet furnaces (80%) and wood- or pellet-burning stoves (70%) are more reliable as testing to estimate efficiencies has been done on these appliances.

The following table is a summary of customer perspective payback periods for several of the scenarios analyzed and discussed in the technical supplement.

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<sup>5</sup> The current average price of delivered natural gas to residential customers in Wisconsin is about \$1.25 per therm. The current average cost of LP gas is about \$2.33 per gallon. This makes LP gas significantly more expensive on a cost per million BTU bases (\$25.47 vs. \$12.50).

Payback Periods (in years) for Selected Scenarios - <b>FURNACE</b>						
Scenario:	Natural Gas			LP Gas		
	Savings	Cost	Payback	Savings	Cost	Payback
Wood (Existing Home, 80%)	\$193	\$2,550	13	\$1,646	\$2,550	2
Wood (Existing Home, 92%)	\$168	\$2,550	15	\$1,431	\$2,550	2
Wood (New Home, 80%)	\$129	\$5,100	40	\$1,095	\$5,100	5
Wood (New Home, 92%)	\$112	\$5,100	46	\$954	\$5,100	5
Outside Boiler (Existing Home, 80%)	NA	NA	NA	\$1,646	\$3,550	2
Outside Boiler (Existing Home, 92%)	NA	NA	NA	\$1,431	\$3,550	2
Outside Boiler (New Home, 80%)	NA	NA	NA	\$1,095	\$7,100	6
Outside Boiler (New Home, 92%)	NA	NA	NA	\$954	\$7,100	7
Wood Pellets (Existing Home, 80%)	-\$2	\$2,800	-1,364	\$1,451	\$2,800	2
Wood Pellets (Existing Home, 92%)	-\$2	\$2,800	-1,568	\$1,262	\$2,800	2
Wood Pellets (New Home, 80%)	-\$1	\$5,600	-4,091	\$967	\$5,600	6
Wood Pellets (New Home, 92%)	-\$1	\$5,600	-4,705	\$841	\$5,600	7

Payback Periods (in years) for Selected Scenarios - <b>STOVE</b>						
Scenario:	Natural Gas			LP Gas		
	Savings	Cost	Payback	Savings	Cost	Payback
Wood (Existing Home, 80%)	\$351	\$1,550	4	\$1,586	\$1,550	1
Wood (Existing Home, 92%)	\$305	\$1,550	5	\$1,379	\$1,550	1
Wood (New Home, 80%)	\$234	\$3,100	13	\$1,057	\$3,100	3
Wood (New Home, 92%)	\$203	\$3,100	15	\$919	\$3,100	3
Free Wood (Existing Home, 80%)	\$1,006	\$1,550	2	NA	NA	NA
Free Wood (Existing Home, 92%)	\$875	\$1,550	2	NA	NA	NA
Free Wood (New Home, 80%)	\$671	\$3,100	5	NA	NA	NA
Free Wood (New Home, 92%)	\$583	\$3,100	5	NA	NA	NA
Wood Pellets (Existing Home, 80%)	\$178	\$1,650	9	\$1,413	\$1,650	1
Wood Pellets (Existing Home, 92%)	\$154	\$1,650	11	\$1,229	\$1,650	1
Wood Pellets (New Home, 80%)	\$118	\$3,300	28	\$942	\$3,300	4
Wood Pellets (New Home, 92%)	\$103	\$3,300	32	\$819	\$3,300	4

Natural Gas @ \$1.28/therm, LP Gas at #2.33/gallon, Wood @ \$187/cord, Pellets @ \$205/ton. New and Existing in the first column indicate new homes or existing homes. Efficiencies in the first column are assumed for the fossil-fuel furnaces.

In summary, there is not likely a market for biomass burning in furnaces in homes that currently use natural gas for heating – which is the market that Focus on Energy is charged with serving. Burning biomass in stoves in homes served by natural gas shows improved homeowner payback periods. We looked at the payback for homeowners who have access to free firewood (though we monetized auxiliary costs for transporting and splitting wood.) In this situation the payback period suggests a likely market.

While there are better economics for LP gas customers, it is uncertain if future Focus funding will cover homes that are heated with LP gas. This analysis does suggest, though, that there is a good opportunity to reduce LP gas usage.

### ***Environmental Impacts***

Burning biomass to heat the home offers some environmental benefits although these are difficult to quantify. No research was found that catalogs the CO<sub>2</sub> emissions of pollutants from wood-burning appliances. Some experts argue that burning biomass results in nearly zero CO<sub>2</sub> emissions compared to fossil fuels. These experts would assert that any CO<sub>2</sub> emitted by burning biomass is equivalent to the CO<sub>2</sub> absorbed from the atmosphere when the biomass grows. While there are CO<sub>2</sub> emissions related to the embodied energy to harvest, process, and deliver the biomass, there are also CO<sub>2</sub> emission related to extraction, processing and delivery of the displaced natural and LP gas. No adequate research and quantification was found to compare these embodied energies. Similarly, it is not possible to quantify the emissions of other pollutants, such as, SO<sub>2</sub>, NO<sub>x</sub>, and Hg, resulting from burning wood, although these deferred emissions from the displaced fossil fuels can be easily quantified. In fact, these emissions can be estimated for pellet fuels burned in EPA certified stoves. As a result, it is impossible to make an apples-to-apples comparison of emissions among the fuels at this point.

### **Feasibility of a Focus on Energy Initiative to Promote Biomass-Burning Furnaces and Stoves**

Focus on Energy staff must consider a variety of issues when deciding whether to include a technology or program in its menu of services. These include conducting a benefit/cost analysis, assessing available budget as well as weighing the economic benefits of the new opportunity.

In addition to this public benefits perspective, any program design must consider the current market infrastructure and the benefits and costs to homeowners likely to install the targeted technology. This was discussed above, in part, as the payback period. Other benefits and costs beyond the payback are also important and are discussed further in the available research supplement.

A variety of benefit/cost analyses of technology and program scenarios were conducted and are discussed in the research supplement. The most relevant scenarios are discussed here.

For a program to be viable from the public benefits perspective it must have a Focus Total Resource Cost (TRC) benefit/cost ratio of 1.00 or greater.<sup>6</sup> Typically, priority is given to programs with the highest benefit/cost ratio so that the program can deliver

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<sup>6</sup> The Focus on Energy program utilizes a Total Resource Cost test to analyze benefit/cost ratios. This test is one of the standard benefit/cost tests utilized in the energy industry and takes into account benefits and costs from both the program and the participant perspective.

maximum benefits. With regard to displacing natural gas, only one scenario has both a benefit/cost ratio greater than 1.00 and provides positive environmental benefits. This, then, is the only scenario appropriate for Focus on Energy consideration.

The first table below shows that at current costs of all fuels none of the biomass scenarios pass the TRC tests compared to natural gas furnaces. The only scenario that we investigated that passes the TRC test where a stove is installed is the scenario where the homeowner has access to free firewood. In this case we assumed the cost of acquiring, transporting, splitting and preparing the wood is about \$50/cord (with significant un-quantified time commitment.)

However, where the homeowner buys a stove, there are a variety of scenarios where the payback is palatable to the homeowner, despite the scenarios failing the TRC test.

Unsurprisingly, most of the scenarios where LPG is being displaced pass the TRC test.

TRC and Payback Periods (in years) for Selected Scenarios - <b>FURNACE</b>				
Scenario:	Natural Gas		LP Gas	
	TRC	Customer Payback	TRC	Customer Payback
Wood (Existing Home, 80%)	0.84	13	1.59	2
Wood (Existing Home, 92%)	0.82	15	1.54	2
Wood (New Home, 80%)	0.60	40	1.13	5
Wood (New Home, 92%)	0.56	46	1.06	5
Outside Boiler (Existing Home, 80%)	NA	NA	1.19	2
Outside Boiler (Existing Home, 92%)	NA	NA	1.16	2
Outside Boiler (New Home, 80%)	NA	NA	0.84	6
Outside Boiler (New Home, 92%)	NA	NA	0.79	7
Wood Pellets (Existing Home, 80%)	0.66	-1,364	1.25	2
Wood Pellets (Existing Home, 92%)	0.65	-1,568	1.22	2
Wood Pellets (New Home, 80%)	0.49	-4,091	0.93	6
Wood Pellets (New Home, 92%)	0.46	-4,705	0.87	7

TRC and Payback Periods (in years) for Selected Scenarios - <b>STOVE</b>				
Scenario:	Natural Gas		LP Gas	
	TRC	Customer Payback	TRC	Customer Payback
Wood (Existing Home, 80%)	0.83	4	1.54	1
Wood (Existing Home, 92%)	0.82	5	1.51	1
Wood (New Home, 80%)	0.65	13	1.21	3
Wood (New Home, 92%)	0.62	15	1.15	3
Free Wood (Existing Home, 80%)	2.68	2	NA	NA
Free Wood (Existing Home, 92%)	NA	2	NA	NA

Free Wood (New Home, 80%)	1.54	5	NA	NA
Free Wood (New Home, 92%)	NA	5	NA	NA
Wood Pellets (Existing Home, 80%)	0.71	9	1.32	1
Wood Pellets (Existing Home, 92%)	0.70	11	1.29	1
Wood Pellets (New Home, 80%)	0.57	28	1.05	4
Wood Pellets (New Home, 92%)	0.55	32	1.01	4

Cells that are shaded green pass the test. The cells that are brighter green are those that pass the tests for stoves but did not pass for furnaces. Those not shaded do not pass the test. Passing the test for TRC is that it is greater than 1.00. Passing from the customer perspective is a payback of 15 years or less.

The outside wood boiler scenario requires some further discussion. The high cost and low efficiency of the “system” limits its value where natural gas is available. Also, the analysis done assumes that only orange tag boilers are eligible for the program – so that the program does not contribute to the often local pollution problems created by use of this technology. The “NA” in the TRC column is a result of our not running the TRC test because it is obvious from running this technology for the case where LPG is the base case available fuel. Given that the cost per million BTU for LPG is more than twice the cost of natural gas, and that this technology did not fare well in the TRC tests, we saw no reason to run the natural gas situation through the test.

The TRC analysis considered several program administration and incentive options:

- Awareness (and education) only
- Awareness and rebate
- Awareness complemented with infrastructure support
- Awareness and rebate complemented with infrastructure support

Each of these options, based on the current benefit/cost analysis approach, provided similar results – for displacement of natural gas using biomass for heating, the program should target high heating load homes.

While some of the organizations interviewed would like to see a rebate offered, others asserted that unless the rebate is at least 10% to 20% of the cost or the burner, the money could be better spent building awareness.

It is notable that two of the dealers we interviewed stated, without prompting, that Focus should not provide incentives for biomass appliances during the upcoming (2008-2009) heating season. The demand currently outstrips the supply and incentives would likely bring non-committed sellers of appliances who will not be around to support customers’ appliance and fuel needs in the future.

Also, the 2005 Energy Bill passed by the federal government has a mechanism for providing financial incentives for burning biomass. However, this mechanism has not yet been funded. It appears prudent for Focus on Energy to refrain from offering a financial incentive as part of an early program to see if this federal program will be funded. Additionally, it is reasonable that a program should initially be designed without an incentive to test the necessity of an incentive.

## Conclusions and Recommendations

It is clear from this research that displacing natural gas by burning wood or wood pellets has limited market potential - yet there are more opportunities to displace LP gas. Targeting either fuel may provide environmental benefits. The analysis shows that based on the current approach to the public benefits benefit/cost test any program to increase the penetration of biomass burning appliances should be targeted to older homes with high heating loads. There is likely a large market of homes in Wisconsin that either are not good candidates for cost effective conservation upgrades or whose owners would rather install a biomass burning appliance than try to significantly insulate their homes.

There are likely tens of thousands of homes in rural Wisconsin which might be good candidates for this technology although it is not clear how many of these homes are eligible for Focus programs.

Properly targeting and managing the complex biomass market will take some special effort in the first couple of years. While the market players would accept an increase in awareness building, given the limited market of interest to Focus, it might be challenging to target the message without potentially negatively impacting the existing marketing efforts. This might be best managed by appointing a program manager to develop this program for the first couple of years.

And given the potential incentive program from the federal government, it is prudent that Focus elect not to offer a rebate for this technology at this time. If the federal legislation remains unfunded, Focus could offer an incentive at a later date with a better understanding of the market and program potential.

Also, a phased approach to growing the program would be prudent because of the instability of the cost natural gas; and potentially wood pellets.

In the event that Focus on Energy decides to develop a biomass burning appliance program for heating homes our recommendations are to go slow, conducting a limited program without rebates that focuses on increasing consumer awareness of biomass burning furnaces and stoves and on building market infrastructure. The market support might include developing collaborations between appliance dealers and wood and pellet retailers. This approach would enable Focus to continue to learn about this market and adapt its program offerings as the market—and Focus' understanding—evolves.

There is more discussion of these recommendations in the [Wood and Pellet Burning Program Feasibility Report Tech Supplement](#).