Woodsmoke in Oregon: House Bill 3068 - 2015 Final Report to Legislature

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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

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Executive Summary

Woodstove smoke is one of the most significant sources of fine particulate and toxic air pollution in Oregon, often jeopardizing public health and putting communities at risk of violating federal air quality standards. Because of the growing concern about the health and economic effect of woodsmoke in communities House Bill 3068 (2015) directed DEQ to form a workgroup to study and develop recommendations to reduce woodstove smoke for legislative consideration.

Woodsmoke workgroup and public meetings

DEQ formed a diverse 22-member work group to help inform the study and recommendations. The work group included both rural and urban community leaders and local government officials from areas where attainment of national air quality standards is a concern as well as representatives from industry, the conservation community, health organizations, pellet fuel interests, and other state agencies. A full list of workgroup members can be found in Section 1.1 of this report. Near the conclusion of the workgroup meetings, DEQ also took the workgroup's draft findings and recommendations to nine communities (Burns, La Grande, Pendleton, Klamath Falls, Lakeview, Medford, Oakridge, Beaverton, and Prineville) around the state. The results of the workgroup and public comment highlighted the widely different needs and approaches to reduce woodsmoke between rural and urban areas and the need for an enhanced partnership between the state and local communities to address the negative public health and economic effects of excessive woodsmoke.

Recommendations

To achieve the goal of helping Oregon communities reduce woodsmoke, the report highlights three priority recommendations for legislative consideration. The priority recommendations are focused on the communities dealing with the public health and economic threat of being designated nonattainment for federal air quality standards. The report includes other strategies that can provide statewide benefits regardless of whether the community is at risk of meeting the federal health standard or not. It also provides a way to address hotspots and vulnerable populations at risk in any neighborhood in Oregon, with the added co-benefit of reducing air toxics emissions from woodsmoke. Each recommendation and the other strategies are described in more detail in the full report.

<u>Priority actions to address nonattainment risk</u>

1) ***Funding for local communities to implement woodsmoke reduction programs*.**
   Locally-run woodsmoke reduction programs are critical to maintaining or achieving clean air and at least part-time programs are required for some former nonattainment communities under their federally approved clean air plans. Local communities understand the challenges of their area and can craft effective woodsmoke reduction programs that include woodstove curtailment and education and outreach messages specifically tailored for their residents.

   Current state funding of approximately $170,000 per biennium only covers part of the cost to implement minimal woodsmoke reduction programs in seven communities. By increasing state funding for local woodsmoke reduction by a range of $550,000 - $700,000 per biennium, each community could employ a full-time or part-time dedicated staff person to implement a woodstove curtailment program, expand its education and outreach efforts, and administer woodstove changeout programs. With additional funding several more communities that are at risk of violating federal health standards might also be able to implement their own reduction programs to avoid a nonattainment designation.

2) ***Sustained funding for woodstove changeout programs with a special consideration given to serious nonattainment areas or those at risk of being declared serious nonattainment.***
   There are approximately 150,000 uncertified stoves in the state. Oregon has a long and successful history of replacing woodstoves in certain communities, but money is sporadic and limited. Sustained funding is the only way to ensure communities have a consistent, reliable source of funding. An allocation in the range of $3-$5 million per biennium could target high risk communities and would support a meaningful level of effort

to replace old, dirty woodstoves. Funding priority would be given to serious nonattainment areas or those communities at risk of serious nonattainment. To reach the full universe of older woodstoves, funding must be available to homeowners and landlords.

3) ***Increase education and outreach across the state on the health effects of excessive woodsmoke***
Increasing awareness of the woodsmoke problem is an essential component to implementing effective reduction programs. If residents do not understand why reducing woodsmoke is important, then needed or existing locally-based reduction programs could fail or be severely hindered. To date, limited state and local resources have resulted in limited outreach. With an additional staff person and technology support, the state could develop a suite of tools and programs that local communities and residents could use to address their individual outreach and education needs.

Additional actions to address woodsmoke
DEQ and the workgroup also discussed and identified other actions to help reduce woodsmoke. These strategies in combination with the priority recommendations above build on existing reduction programs. They include:

4) ***Enhance coordination among state agencies to focus on air quality areas of concern*.**
Additional collaboration from other state agencies could further address other facets related to woodsmoke reduction – including home weatherization and energy assistance. If state agencies could expand upon or further link their program goals to the larger issue of trying to address woodsmoke and public health, it could foster additional partnership opportunities to implement woodsmoke reduction programs and outreach.

5) ***Provide a tax credit for the purchase of premium efficiency heating devices***
Replacing old woodstoves with the cleanest burning, highest efficiency devices such as certified woodstoves, pellet stoves, or ductless heat pump is the goal of most communities facing nonattainment. A tax credit could motivate the purchase of the cleanest devices especially if the new device is replacing an uncertified woodstove.

Other supporting actions for Legislative consideration
House Bill 3068 directed DEQ to address other topics including the use of biomass in home heating; opportunities to develop the production and use of high-quality wood pellet fuel in Oregon; the role of subsidies to encourage wood pellet use in households; and options for reducing the cost of using woodstove alternatives for home heating during poor air quality days. DEQ and the workgroup identified these supporting actions the Legislature could consider and take action on to further reduce woodsmoke. The strategies include:

- Incentivize uncertified woodstove replacements with pellet stoves
- Conduct a biobrick/biolog study
- Partner a local community's woodsmoke reduction program with utilities to address heating needs during poor air quality days

Conclusion
Oregon has had a long history of addressing woodsmoke in the state and attaining federal air quality standards would not have been possible without state and local partnerships to tackle the woodsmoke problem. DEQ and local communities continue to work together to develop community plans and strategies to reduce woodsmoke levels. These recommendations build upon the past successes of state and local efforts and provide a targeted, coordinated approach to ramp up the state-local effort to reduce woodstove smoke.

The recommendations prioritize programs that could provide immediate woodsmoke reductions. The recommendations include robust woodsmoke reduction programs on the local level, a sustained woodstove changeout program, and enhancement of state and local education and outreach efforts. These recommended strategies provide the ability to achieve meaningful reductions by focusing on communities where attainment of national air quality health standards is a concern and has the added co-benefit of reducing air toxics emissions from woodsmoke in communities all across Oregon.

A full copy of the report is available at: http://www.deq.state.or.us/aq/burning/docs/SB3068Report.pdf

1. Introduction

This report responds to House Bill 3068 (2015), which directs DEQ to conduct a study and develop recommendations for legislation to reduce woodstove smoke in Oregon, particularly in communities where attainment of the national air quality standards is a concern. The bill also directs DEQ to explore options for transitioning from older, high-polluting woodstoves to cleaner burning home heating alternatives including non-wood heating systems and for reducing the cost of using woodstove alternatives for home heating during poor air quality days. Additionally, the bill directs DEQ to explore the use and production of residential biomass fuel.

1.1 Membership

DEQ convened a 22 member woodsmoke work group to inform the study and provide recommendations for legislation or budget requests. DEQ selected members that reflect the range of entities affected by woodstove smoke, biomass, and non-wood residential heating and are representative of rural and urban communities, particularly from areas where attainment of the national air quality standards is a concern. The workgroup included members of the general public, conservation, economic development, and health organizations that are impacted by woodstove smoke. There are members representing pellet fuel interests that can address the issues concerning residential biomass and non-wood heating system use. DEQ also included multiple state agencies as ex-officio members of the workgroup.

Workgroup Members included:

Jane O'Keeffe (Chair & Facilitator)	Environmental Quality Commission Chair, Former Lake County Commissioner
Sarah Altemus-Pope	Oakridge – SW Forest Collaborative
Peter Brandom	City of Hillsboro
David Breen	Port of Portland
Jess Brown	Collins Company (Klamath Falls and Lakeview)
Matt Davis	Washington County Public Health
Spencer Ehrman	Citizen
Steve Forrester	City of Prineville
Chris Hagerbaumer	Oregon Environmental Council
Ken Kestner	Lake County Commissioner
Dylan Kruse	Sustainable Northwest
Tim Reed/ Harvey Gail	Oregon Hearth Patio Barbecue Association
Bob Sourek	Bear Mountain Forest Products
Gary Stevens	Former Jackson County Environmental Health Manager, retired
Marilyn Sutherland/ Ramona Quinn	Klamath County Environmental Health Department
Ex-Officio Members	
Dan Elliott	Oregon Housing and Community Services
Merlyn Hough / Jo Niehaus	Lane Regional Air Protection Agency
Todd Hudson	Oregon Health Authority
Marcus Kauffman	Department of Forestry
Rob Delmar	Department of Energy
Jason Salmi-Klotz	Public Utilities Commission

1.2 Scope, Workgroup Schedule & Public Meetings

1.2.1 Scope

Woodstove Smoke Discussion
The work group discussed and provided recommendations on strategies and funding options that the legislature can respond to, such as:

- Woodstove changeouts
- Community program support for education and outreach, including administration and enforcement of air quality advisories, and curtailment programs
- Finding low-cost or reducing the cost of woodstove alternatives during poor air quality days
- Administrative costs for implementing wood stove replacement projects
- Economic and public health effects on communities where attainment of national air quality standards is a concern

Residential Biomass and Alternative Non-wood Heating System Discussion

The work group discussed the feasibility and potential funding options regarding:

- Pellet fuel production and supply for residential use
- Non-wood heating systems
- Residential pellet fuel, biobrick, and non-wood heating system subsidies

The purpose of the workgroup was to evaluate current programs and identify new strategies and funding options to maintain and build upon the current progress DEQ has made to address woodstove smoke.

1.2.2 Schedule & Public Meetings

Work group meetings were held through December 2015 through July 2016 to provide input, develop ideas, and assist DEQ in its report to the Legislature, due in September 2016. The schedule and topics for each meeting were as follows:

Meeting #1:	Background (Woodstoves, Nonattainment, Program Overview)
Meeting #2:	Woodsmoke Programs & Funding
Meeting #3:	Biomass and Alternative Non-Wood Heating
Meeting #4:	Development and Review of Workgroup Recommendations
Meeting #5:	Review of Workgroup Recommendations

Between meetings #4 and #5, DEQ took the workgroup's draft findings and recommendations to nine communities (Burns, La Grande, Pendleton, Klamath Falls, Lakeview, Medford, Oakridge, Beaverton, and Prineville) around the state. DEQ held meetings that included the public, city, county, and elected officials in each community. The purpose of the meetings was to get both urban and rural community perspectives on the committee's initial conclusions and recommendations. For the most part, densely populated urban areas wanted to take more restrictive actions to mitigate woodsmoke effects while rural areas favored effective solutions to bring areas into compliance without compromising their ability to burn wood. The results of the workgroup and public comment highlight the widely different needs and approaches to address woodsmoke between rural and urban areas and the continued need for local community and state partnerships to address the woodsmoke issue in a way that is most effective for each community.

1.3 Summary of Workgroup Meeting Discussion

During the meetings, the workgroup reviewed background information related to why woodsmoke is a concern, the health effects of woodsmoke, cultural practices and perceptions surrounding woodsmoke and woodburning, nonattainment implications, and unique challenges for some communities to address woodsmoke. The workgroup also discussed woodstove changeout programs and other programs to reduce woodsmoke both in Oregon and nationwide. The workgroup reiterated how essential it is to design and fund a successful and effective local air

quality program that includes public engagement and assistance. They also identified the funding challenges to making that happen, the critical need to finance these programs, and how that could be accomplished through public, private, and philanthropic partnerships. The workgroup also discussed biomass fuel, its production and use in Oregon and the current barriers to expanding the market. The workgroup also discussed and considered options for encouraging residential biomass and non-wood heating alternatives and in particular explored options for utilizing biobricks/biologs.

In developing the recommendations, the workgroup discussed real world examples and realities of how communities are trying to tackle the problem and what will and will not work (including an acknowledgment of a strong culture of woodstove use, lack of local staffing to implement programs, an easily accessible wood supply, and economic barriers to struggling communities). They also discussed measures they felt were needed to address the woodsmoke issue. A full summary of the workgroup discussions is available in Appendix A.

2. Recommendations

2.1 Background

Woodsmoke contains both fine particulate and toxic air pollutants that can pose health risks in communities all across Oregon. Woodstove smoke is a problem for a number of areas that struggle with public health and economic threat of being designated as nonattainment under the federal Clean Air Act. Nonattainment occurs as a consequence of violating federal air quality health standards. Any area designated as nonattainment means the air is unhealthy and it can impose restrictive requirements on local industrial sources, which can be a detriment to economic development and attracting new businesses.

Oregon has over a 30-year history of addressing areas that have violated federal health standards due to woodsmoke and has successfully brought those areas back into compliance. A key component of this success is through state and local partnerships to tackle the woodsmoke problem. DEQ and local communities have worked together to develop community plans to reduce levels for large particulate, known as PM10, in La Grande, Grants Pass, Medford, Lakeview, Klamath Falls, and Eugene. The state and local partnership has been successful and these areas continue to maintain compliance with the large particulate standard. However, EPA has more recently updated the standard for fine particulate, known as PM2.5, due to recent health studies showing that fine particulate is more dangerous than previously thought. These fine particles are so small that they get past the respiratory tract's defenses and reach the deepest areas of the lungs. The result of the updated standard is additional communities are either violating or at risk of violating the standard including Oakridge, Klamath Falls, Lakeview, Prineville, Medford, and Hillsboro/Washington County.

Toxic air pollutants such as benzene and naphthalene are also associated with woodsmoke. Woodsmoke burning is a problem statewide, as high concentrations of benzene exist in most counties in Oregon. In 2011, DEQ monitored for toxic air pollutants in Klamath Falls. An analysis of the data showed that benzene levels in Klamath Falls were four and a half times above the DEQ air toxics annual benchmark or clean air goal[1]. Monitoring also showed that benzene levels were highest between November and January when woodstoves were in use. Efforts to reduce woodsmoke to meet national standards for particulate should also reduce toxic air pollution that is linked to increased cancer risk.

To achieve the goal of helping Oregon communities reduce woodsmoke, the report highlights three priority recommendations for legislative consideration. The priority recommendations are focused on the communities dealing with the public health and economic threat of being designated nonattainment for federal air quality standards. The report includes other strategies that can provide statewide benefits regardless of whether the community is at risk of meeting the federal health standard or not. It also provides a way to address hotspots and

[1] http://www.deq.state.or.us/aq/planning/docs/FSKlamathFallsAirToxics.pdf

vulnerable populations at risk in any neighborhood in Oregon, with the added co-benefit of reducing air toxics emissions from woodsmoke.

The three priority recommendations that provide the biggest impact in addressing woodsmoke are:

- Funding for local communities to implement woodsmoke reduction programs.
- Sustained funding for woodstove changeout programs with a special consideration given to serious nonattainment areas or those at risk of being declared serious nonattainment.
- Increased education and outreach across the state on the health effects of excessive woodsmoke.

2.2 Priority actions to address nonattainment risk

2.2.1 Funding for local communities to implement woodsmoke reduction programs

Locally–run woodsmoke reduction programs understand the challenges of their community and can craft the most effective programs. The local programs can develop a woodstove curtailment program and an education and outreach program specifically tailored for their residents.

A core feature of woodsmoke reduction is the resource intensive woodstove curtailment program. It requires daily air quality forecasting, public notification, compliance monitoring, technical assistance, and if needed, enforcement. A local air quality coordinator is essential for implementing this critical program, as well as conducting year-round education and outreach to the community. Other work of the local coordinator includes identifying the universe of old stoves in the community. This information is needed to administer a focused woodstove changeout program. The local coordinator can also write and pursue grants and leverage local partnerships to supplement woodsmoke reduction programs and increase home weatherization. Investing in local air programs is the most effective way to address a community's immediate needs for smoke reduction as well as maintain the gains over time to ensure compliance with health standards. Local programs are critical to maintaining or achieving clean air and at least part-time programs are required for some former nonattainment communities under their federally approved clean air plans.

Currently, there are seven local woodsmoke reduction programs operating in Oregon. They include: Klamath Falls, Oakridge, Lakeview, Prineville, Medford, Eugene, and Grants Pass. These programs are funded by DEQ in partnership with the local governments. The legislature appropriates General Fund of approximately $85,000 per year ($170,000 per biennium) in DEQ's budget, which DEQ provides to the seven communities. Current state funding only supports a portion of the cost of a part-time coordinator in these communities.

By increasing the state funding for local woodsmoke reduction programs by a range of $550,000 to $700,000 per biennium[2], each community could employ a full-time or part-time dedicated staff person to implement a woodstove curtailment program, expand its education and outreach efforts, and administer woodstove changeout programs. With additional funding several more communities that are at risk of violating federal health standards might also be able to implement their own reduction programs to avoid a nonattainment designation.

The additional funding could be distributed to the communities based on a scalable approach. For example, state funds could cover most of the local woodsmoke reduction costs for communities that are economically distressed while the community provides some limited in-kind resource contribution. In areas experiencing somewhat better economic conditions, the community would be expected to provide the majority of woodsmoke reduction funding and state resources would supplement the local funding. In addition, funding priority would be given to areas violating the federal health standard. Overall, this increased level of funding – which is critical to an enhanced

[2] In the agency's budget request for 2017-2019, DEQ requested an additional $100,000 to assist local communities. However, this additional funding is inadequate to support all the air quality communities in need, as it would not fully cover the costs of a full-time local air quality staffer in the existing funded communities nor allow the funding of any new communities that are at risk of violating health standards. The additional $100,000 funding request is a placeholder until a final amount is determined by the Legislature.

state and local partnership - is important for a community's ability to address woodsmoke and to maintain progress.

2.2.2 Sustained funding for woodstove changeout programs with a special consideration given to serious nonattainment areas or those at risk of being declared serious nonattainment

Woodstove replacement is one of the key strategies for communities to address woodsmoke. Uncertified woodstoves (any stove manufactured before 1986), emit up to 70% more particulate air pollution and 25% more benzene (toxic air pollutant) than newer "certified" woodstoves that meet federal emission standards. There are approximately 150,000 uncertified stoves in the state, and these old stoves play a critical reason for why areas are at risk of violating health standards. Often older stoves exist in lower income areas of the community where financial assistance is needed to help homeowner's and landlord's transition from old woodstoves to newer, cleaner forms of home heating. Oregon has a long and successful history of replacing woodstoves in certain communities, but money is sporadic and limited; sustained funding is the only way to ensure communities have a consistent source of funding they can rely upon to address the problem and to maintain progress.

An allocation in the range of $3 to $5 million per biennium could target high risk communities and would support a meaningful level of effort to replace old, dirty woodstoves. Old, uncertified woodstoves emit 244 lbs of particulate pollution/year, whereas new certified stoves emit 97 lbs of particulate pollution/year, pellet stoves emit 27 lbs of particulate pollution/year, and electric heat or gas furnaces emit zero to 1/6 lb of particulate pollution/year. There are approximately 150,000 uncertified stoves in the state and the cost of fully replacing each stove could range from $3,000 to $5,000 each. DEQ and the workgroup realized that replacing every single old woodstove in the state would not be financially feasible. Instead, $3 million would provide for the changeout of approximately 600 – 1,000 stoves (using full rebates) and up to 1,000 – 2,000 stoves (using partial rebates) while $5 million could changeout approximately 1,000-1,660 stoves (using full rebates) and up to 1,660 – 3,300 stoves (using partial rebates).

To administer the woodstove changeout effort, the workgroup discussed a range of possible scenarios. One option could be a direct pass-through from DEQ to communities that have applied to participate in the changeout program[3]. Another option could be an allocation to communities to establish a revolving loan program to finance low-interest loans in each community, similar to a revolving loan program for on-site septic systems.

With direct pass-through funding, each community would design the changeout to fit their needs and present a changeout implementation proposal. A community could provide a range of options from offering incentives to partial rebates to full-cost replacements particularly if there are many low income residents. Other program components could include any on-going or planned programs to supplement a change out effort (such as education and outreach, weatherization), a commitment of in-kind resources or matching funds, and a demonstration of how the community will measure air quality improvements.

When determining the allocation of pass-through funds to communities, special consideration should be given to serious nonattainment areas for changeout funding. A serious nonattainment designation means the area has been unable to come into compliance with federal standards within the required time and is required to enact additional and more stringent requirements on woodstove use and industrial development or expansion. This is a particular burden for those communities with a high percentage of low-income renters and homeowners. There exists an urgent need to provide funding to any community to implement immediate reduction measures to avoid this designation. To reach the full universe of older woodstoves, funding must be available to homeowners and landlords.

[3] DEQ has experience administering pass-through changeout programs, most recently in 2009-2011, when it received $2M in American Recovery and Reinvestment Act funds. DEQ provided funding to five communities (Klamath Falls, Lakeview, Oakridge, Eugene- area, and Burns) and replaced almost 700 uncertified woodstoves with cleaner burning devices.

If a low-interest or no-interest loan program for woodstove changeouts is pursued, the program could be modeled after similar programs in Pendleton[4] and Lakeview. Local communities could also provide some of the funding for the local revolving loan program. For these programs, the homeowner or landlord borrows money at low rates or interest free and a lien is placed on the property pending repayment. The full principal amount of the loan is due upon the sale of the home.

To fund the woodstove changeout effort, the workgroup discussed many possible funding options and has suggested two ideas for consideration. The Legislature may wish to explore these options as well as other funding options.

- Create a woodsmoke tax credit that would be auctioned off to fund woodsmoke reduction projects, similar to the Renewable Energy Development Fund (Oregon Revised Statute 315). The fund could be capped at $1.5M-2.5 M per year ($3M-$5M per biennium). Any funds generated by the auction would be deposited into the Residential Solid Fuel Heating Air Quality Improvement Fund (ORS 468A.490), which DEQ could administer.
- Provide a direct allocation of funding for woodstove changeouts. Funding through bonds was considered but it would also require principal and interest pay-back; a direct allocation is administratively easier to manage and provides flexibility to fund communities as they apply for changeout dollars.

DEQ's experience to date with woodstove changeouts shows this is a multi-year effort requiring sustained funding. The ongoing funding provides a level of continuity for communities to know there will be a multi-year funding source to do changeouts and to be part of the larger effort within the community to address woodsmoke. The state has conducted a number of changeouts in the past and this program would build upon past efforts and successes.

Woodstove replacement is expensive and replacing every single stove will not solve the air quality problem on its own. Instead communities must rely on a coordinated state and local partnership to changeout woodstoves, coupled with education and outreach, weatherization, and woodstove curtailment to really be effective.

2.2.3 Increased state-wide education and outreach across the state on the health effects of excessive woodsmoke

Increasing awareness of the woodsmoke problem is an essential component to implementing effective reduction programs. During the workgroup discussions, many members indicated the key to a successful and effective woodsmoke reduction program was having the public be aware of how woodsmoke can affect their health, their neighbor's health, and the economic well-being of the community. If residents do not understand why reducing woodsmoke is important, then needed or existing locally-based reduction programs could fail or be severely hindered.

Increasing education and outreach across the state requires additional staffing and resources to fill this critical void. To date, limited state and local resources have resulted in limited outreach in some communities and prevented education and outreach program expansion. A specific challenge for many communities is reaching out to underserved populations or neighborhoods, particularly in areas of heavy woodstove use. Additional staffing, such as one FTE at the state level, and some contract funding for technology support could provide for the development of a suite of tools that local communities and residents could access to address their individual outreach and education needs. Some examples of the work/tools would be: creating educational videos in multiple languages to reach potentially underserved communities, expanding a community's social media presence with informational tweets and posts about woodburning, providing year-round education through informational billboards, radio spots, newspapers, and television ads, and developing outreach materials that can be easily tailored for each specific community. The additional resources would also free up existing DEQ staff to visit communities more often and to establish key partnerships with local community leaders.

[4] The city of Pendleton has administered a woodstove changeout revolving loan program for the past 16 years. It has changed out 135 stoves over the course of the program. More details are available in Section 7.2.1.4 of the report.

2.3 Additional actions to address woodsmoke

DEQ and the workgroup also discussed and identified other actions to help reduce woodsmoke. These strategies in combination with the priority recommendations above build on existing reduction programs. They include:

- Enhance coordination among state agencies to focus on air quality areas of concern
- Provide a tax credit for the purchase of premium efficiency heating devices

2.3.1 Enhance coordination among state agencies to focus on air quality areas of concern

Over the past few years, DEQ, Oregon Department of Energy, Regional Solutions Team[5], and Oregon Department of Forestry have worked together to address woodsmoke through changeouts and biomass utilization. Additional collaboration from other state agencies could further address other facets related to woodsmoke reduction– including home weatherization and energy assistance. If state agencies such as Oregon Housing and Community Services and the Oregon Health Authority, could expand upon or further link their program goals to the larger issue of trying to address woodsmoke and public health, it could foster additional partnership opportunities to implement woodsmoke reduction programs and outreach.

For example, the Oregon Housing and Community Services Department currently receives funding through their Low Income Home Energy Assistant Program (LIHEAP) to assist low income residents with changeouts and weatherization. Directing some of this funding to air quality areas of concern would address a dual purpose of assisting low income residents who might be at greater risk because of the poor air quality existing in their current community. The Oregon Health Authority[6] could expand its current health risk assessment through the Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE) program looking at correlations between hospital visits and poor air quality days. Providing more coordination between agencies to combine assistance, potential funding, and resources gives communities more tools to address woodsmoke.

2.3.2 Provide a tax credit for the purchase of premium efficiency heating devices.

The workgroup noted the importance of replacing old woodstoves with the cleanest burning, highest efficiency devices. The workgroup recommended renewing the existing Oregon Department of Energy tax credit to Oregon residents for the purchase of a new, highest energy efficient, heating device[7] and providing a new, additional incentive if the new device is replacing an uncertified stove. Incentivizing cleaner burning heating devices would provide another pathway to ensure only the cleanest burning, highest efficiency devices are installed in homes.

2.4 Other supporting actions for Legislative consideration

House Bill 3068 directed DEQ to address other topics including the use of biomass in home heating; opportunities to develop the production and use of high-quality wood pellet fuel in Oregon; the role of subsidies to encourage wood pellet use in households; and options for reducing the cost of using woodstove alternatives for home heating during poor air quality days. DEQ and the workgroup identified these supporting actions the Legislature could consider and take action on to further reduce woodsmoke. The strategies include:

- Incentivize uncertified woodstove replacements with pellet stoves

[5] In 2015, the Regional Solutions Team acquired $1.5M in legislative funding to conduct changeouts in the Klamath Falls and Lakeview areas.

[6] In 2013, OHA provided $100,000 for woodstove changeouts and weatherization in Klamath Falls.

[7] Currently, the Oregon Department of Energy offers a tax credit to Oregon residents for the purchase of a new, highest energy efficient, clean burning woodstove, pellet stove, or ductless heat pump, regardless of whether it is replacing an old, uncertified stove. The program has been in effect since 2009 although the amount of tax credit has varied from year to year based on changes to administrative rules. To date, over 22,000 residents have utilized the tax credit[7]. The tax credit program will sunset at the end of 2017.

- Conduct a biobrick/biolog study
- Partner a local community's woodsmoke reduction program with utilities to address heating needs during poor air quality days

2.4.1 Incentivize uncertified woodstove replacements with pellet stoves

HB 3068 directed DEQ to explore opportunities to develop and expand the market for residential biomass fuel as well as study the options of subsidies for wood pellet fuel. Biomass materials, such as wood pellet fuel provide a clean burning heating fuel option for homeowners. Using such manufactured biomass fuels as a substitute for traditional cordwood is an effective strategy for reducing woodstove smoke. These manufactured fuels are inherently cleaner burning than traditional cordwood and can significantly reduce air pollution from wood-based home heating. This strategy is particularly attractive in communities with a strong culture of home wood heating that need to significantly reduce woodstove smoke.

While Oregon currently has a robust and mature biomass fuel manufacturing base, challenges exist with expanding the marketplace. This is due to low market demand, low natural gas prices, few pellet stoves in residences, and a mild climate all of which make it harder for pellet fuels to maximize its full potential use. In Oregon the manufacture of residential wood pellet fuel is under-utilized; increased demand would fully capitalize the existing market.

Providing incentives for the purchase and installation of pellet stoves, such as Oregon Department of Energy's existing tax credit for pellet stoves, particularly to replace old uncertified stoves would increase pellet fuel demand. This strategy aligns with the priority recommendations of replacing old, uncertified stoves with cleaner burning devices. While options for incentivizing pellet fuel were considered, it would require choosing a specific type of pellet - limiting consumer choice. Additionally, in the absence of certification requirements for pellet fuel it would be harder to ensure only quality pellet fuel is used. With pellet stoves, all stoves are required to be certified and tested to meet specific emission requirements and it allows the consumer to choose from many different high quality pellet stoves for their use.

A tiered rebate for the purchase of pellet stoves is a potential option for incentives. The rebate could be offered in conjunction with a tax credit, and if the purchaser has no tax liability (such as a low-income resident) then the amount of the anticipated tax credit would be added to the total rebate amount. Rebate amounts would cover up to a third of the cost of the pellet stove or no more than $1,000 per device. Additional funding could be provided through manufacturer discounts and potential grants from the wood pellet industry.

2.4.2 Conduct a biobrick/biolog study

Biobricks and biologs (compressed wood bricks) are burned in woodstoves, while wood pellets can only be used in pellet stoves. Biobricks could be an option for homeowners who want to continue to use their woodstoves but need a cleaner burning fuel. This can be particularly useful for households during poor air quality days when use of cordwood burning devices may be banned. Biobricks are produced in several states, including here in Oregon[8]. However, biobricks or biologs are not as widely used or known to woodstove users because the majority of woodstove burners use traditional cordwood.

There is limited biobrick emission test data available to evaluate their potential as an emission reduction strategy. Conducting a biobrick/biolog study would provide information about the emissions and safety characteristics of burning biobricks/biologs in wood burning stoves. Currently, woodstoves are certified and tested with cordwood; biobricks, which would be burned in a woodstove, have not undergone the same amount of standardized testing. Additional study could ensure households are burning a fuel that has been rigorously tested like cordwood and pellet fuel, and provide assurance that it is an emission reduction measure both local communities and EPA could support.

[8] Bear Mountain Forest Products, Ochoco Lumber

2.4.3 Partner a local community's woodsmoke reduction program with utilities to address heating needs during poor air quality days

HB 3068 directed DEQ to look at options for reducing the cost of using woodstove alternatives for home heating during poor air quality days. In many communities woodstove curtailment programs ask or prohibit the use of wood burning stoves when air quality is forecasted to be poor. For low income homeowners, using an alternate form of heat (such as gas, electric, or oil) could be an added cost they cannot afford.

To help these homeowners comply with woodsmoke curtailment programs each local community's woodsmoke reduction program could partner with local utilities and design a customized approach that works for that community. There are many complexities in each utility service area and in some areas limitations exist on alternative heating options such as natural gas availability. A one-size fits all statewide approach to address woodstove alternatives would not be feasible and it underscores the critical need to fund local woodsmoke reduction programs so that they have the capacity to work with the local utility to build relationships, seek funding, and reach out to folks who need assistance.

One approach to reducing the cost of alternative heating systems during poor air quality days is to create a reimbursement program or fund to provide low income people relief on heating bills. This fund could be provided through the local utilities, federal grants, or other weatherization and low-income programs.

2.5 Ideas raised by the workgroup and public comment

The workgroup discussed many ideas to reduce woodstove smoke and benefit public health. During the course of the workgroup meetings, DEQ also took the workgroup's initial findings and recommendations out to various communities around the state to solicit comment from the public. Some of the comment received provided additional suggestions and strategies to address woodsmoke, which the workgroup considered. The workgroup recognized there is no one-size fits all approach for these additional strategy approaches. Some of the concepts for reducing woodstove smoke could be pursued at the local level, such as in incorporated areas only. However, while a few members of the workgroup recommended these additional actions should go forward, there was not full agreement on all of the strategies. Instead these strategies are presented to the Legislature for consideration.

2.5.1 Strategies for consideration that could be implemented on a statewide level:

Helping residents understand the health hazards

- Add a disclosure regarding date of the last known fireplace or wood burning appliance cleaning to real estate sales forms and rental agreements.
- Provide information on the PM2.5 health hazards to realtors and landlords to distribute to their clients/tenants.
- Require health impact labeling of firewood sold in commercial establishments (e.g. grocery stores)
- Add residential wood burning appliance disclosures regarding the PM2.5 health hazards of woodsmoke to real estate and rental agreements.

Accelerating the removal of uncertified stoves

- Require removal of uncertified wood burning device at the time of any major home remodel (15% of the home's value)

Preventing additional emissions

- Ban open hearth wood fireplaces in new construction homes

2.5.2 Strategies for consideration that could be implemented on a local, community level

Curbing emissions from existing wood stoves and fireplaces

- Establish regulations for home and commercial woodstoves, and the amount of smoke they emit (opacity requirements – 40%). Require periodic maintenance and inspection of wood-burning devices by a qualified hearth industry specialist and submittal of the maintenance/inspection report to the City/County Building/Planning Department, if the residence has a permit to burn on a red air quality day.

Obtaining better data to help inform future woodstove reduction efforts

- Require registration for wood-burning devices.

Preventing additional emissions

- Restrict or ban the use of backyard fireplaces and fire pits.

Understanding the health hazards of woodsmoke

- Require education on the health effects of wood burning for any commercial or restaurant establishment that is adding a wood fire appliance or is permitted through the building codes to have one installed.

Accelerating the removal of uncertified stoves

- Require any homeowner (including landlords) with an uncertified device to upgrade by a set date (e.g., two years to comply) and any homeowner who fails to do so is subject to penalties for continued use of an uncertified stove.

2.6 Current DEQ actions to address woodsmoke

Reducing woodstove smoke is part of DEQ's multi-pollutant strategy to reduce both fine particulate (which can jeopardize compliance with federal health standards and cause nonattainment) and air toxics (which can increase cancer risk). DEQ is engaged with local elected officials to reduce pollution levels in the communities of Oakridge, Medford, Klamath Falls, Lakeview, and Prineville. These areas are exceeding or are at risk of exceeding fine particulate health standards. DEQ has also reached out to the communities of Burns and Washington County /Hillsboro to raise awareness of the potential for their fine particulate levels to exceed standards. DEQ's goal is to work with citizens and local government officials in these at risk communities to reduce fine particulate levels, restore healthy air quality and avoid a federal nonattainment designation for that community. DEQ will also continue to work with local communities across the state regarding woodsmoke education and outreach.

Another DEQ effort to addressing woodsmoke is the Heat Smart program. It requires the removal of uncertified stoves at the time of home sale. The Heat Smart program provides a long-term effort to assist in the turnover of old uncertified stoves, benefits public health in the neighborhood by reducing air pollution from that home, and improves home safety by replacing old, potentially unsafe stove installations.

2.7 Conclusion

Oregon has had a long history of addressing woodsmoke in the state and attaining federal air quality standards for large particulate would not have been possible without state and local partnerships to tackle the woodsmoke problem. DEQ and local communities continue to work together to develop community plans and strategies to reduce woodsmoke levels. These recommendations build upon the past successes of state and local efforts and provide a targeted, coordinated effort to reduce woodstove smoke.

The recommendations prioritize programs that could provide immediate woodsmoke reductions. The recommendations include robust woodsmoke reduction programs on the local level, a sustained woodstove changeout program, and enhancement of state and local education and outreach efforts. These recommended strategies provide the ability to achieve meaningful reductions by focusing on communities where attainment of national air quality health standards is a concern and has the added co-benefit of reducing air toxics emissions from woodsmoke in communities all across Oregon.

3. Background and Overview

3.1 Why is Woodsmoke a Concern?

Woodsmoke has serious health effects when inhaled. It contains tiny particles of solids and liquids made of incompletely burned wood; these particles include particulate matter (PM), carbon monoxide (CO), and toxic air pollutants (e.g., benzene, formaldehyde). Most woodsmoke is made up of fine particulate matter, which are particles 2.5 microns (μm) or less in size, known as PM2.5. For reference, a strand of hair is 80 microns in diameter. These tiny particles are so small that they get past the respiratory tract's defenses and reach the deepest areas of the lungs. The U.S. Environmental Protection Agency has established a federal health standard for PM2.5 because it is a pollutant considered to be harmful to public health and the environment. (for more information on health effects of PM, see the next section)

Wood burning devices in the U.S. emit more than 345,000 tons per year of PM2.5 into the air, primarily during the winter months.[9] In Oregon, roughly 15,000 tons per year of PM2.5 is emitted.[10] Wood smoke is more of a problem in the winter when cold, stagnant air prevents it from rising and dispersing. As wood burning increases during these cold periods, the pollutants in the smoke are trapped near the ground. In neighborhoods where wood is burned, houses typically have higher indoor smoke levels than houses in neighborhoods where wood is not burned, and outdoor air quality is also compromised. Depending upon chimney heights and locations of houses, particularly in dense neighborhoods, PM2.5 and air toxics emissions from woodstoves can be released at low heights and result in relatively high levels of exposure to residents. In Oregon, wood smoke is of particular concern because it causes air quality problems in many communities and in some cases causes violations of the federal health standard for PM2.5.

3.2 Health Effects

Wood smoke contains a mixture of gases and fine particles that can cause immediate health effects, including burning eyes, runny nose and bronchitis. Many sensitive groups including the elderly, children, and individuals with pre-existing heart or lung disease are at great risk of experiencing PM2.5 and air toxics health effects associated with wood smoke. Both short-term and long-term exposure to PM2.5 has been associated with a range of health effects, including:

Short-term effects such as:

- irritated eyes, throat, sinuses, and lungs;
- headaches;
- reduced lung function, especially in children;
- lung inflammation or swelling;
- increased risk of lower respiratory diseases; and
- risk of heart attack and stroke.
- asthma

[9] U.S. EPA, Office of Air Quality Planning and Standards "Strategies for Reducing Residential Woodsmoke", Publication No. EPA-456/B-13-001, March 2013, p. 5

[10] . http://www2.epa.gov/air-emissions-inventories/2011-national-emissions-inventory-nei-data

Long-term effects such as:

- chronic lung disease including bronchitis and emphysema;
- chemical and structural changes in lungs; and
- cancer

Residential wood combustion in the U.S. accounts for nearly 25 percent of all area source air toxics cancer risks and 15 percent of noncancer respiratory effects[11]. Air toxics, another component of woodsmoke, are generally defined as air pollutants known or suspected to cause cancer or other serious health problems. They also may disrupt reproductive processes and cause birth defects. People exposed to toxic air pollutants at sufficient concentrations and durations have an increased chance of getting cancer or experiencing other serious health effects. These health effects can include damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory and other health problems.

3.3 How Much Air Pollution is in a House with a Wood Burning Device?

Houses using wood heat have higher levels of fine particles, benzene, PAHs, and other chemicals. For example, a study showed that average fine particle levels were up to 26 percent higher in woodburning houses compared to non-wood burning houses.[12] Benzene levels were 29 percent higher.[13] Average levels of cancer-causing PAHs were 300 to 500 percent higher.[14] Wood smoke also pollutes outdoor air, compromising the health of anyone in the vicinity.

3.4 Nonattainment (PM standard, economic implications)

The Environmental Protection Agency, under the federal Clean Air Act, sets health standards for six pollutants, including lead, carbon monoxide, ozone, PM, nitrogen dioxide, and sulfur dioxide. States are required to monitor and identify areas not meeting the standards. Those areas which don't meet the standard are designated as nonattainment and states must develop and implement plans to bring them back into compliance to protect human health.

Oregon has had a long history of dealing with nonattainment. In the late 1980s when the state monitored for PM10 only (the size of particulate pollution regulated at the time), seven areas of the state were in violation of the PM10 standard. EPA designated these seven areas -- Medford, Klamath Falls, Lakeview, Grants Pass, La Grande, Oakridge, and Eugene -- as nonattainment. By the early 1990s all of the areas were in compliance with the PM10 standard, and DEQ had submitted PM10 attainment plans for Grants Pass, Medford, Oakridge, Klamath Falls, La Grande. However, since then, EPA has added PM2.5 to the list of pollutants states must monitor for and has revised the PM2.5 standard twice due to updated health effects information. Oregon has spent the past 30 years trying to reduce PM emissions through various emission reduction strategies including those focused on woodsmoke.

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[11] U.S. EPA, Office of Air Quality Planning and Standards "Strategies for Reducing Residential Woodsmoke", Publication No. EPA-456/B-13-001, March 2013, p. 4

[12] Molnár P, Gustafson P, Johannesson S, Boman J, Barregard L, Sällsten G. 2005. Domestic wood burning and PM2.5 trace elements: Personal exposures, indoor and outdoor levels. Atmospheric Environment 39(14): 2643-2653

[13] Gustafson P, Barregard L, Strandberg B, Sällsten G. 2007. The impact of domestic wood burning on personal, indoor and outdoor levels of 1,3-butadiene, benzene, formaldehyde and acetaldehyde. J Environ Monit. 9(1):23-32

[14] Gustafson P, Ostman C, Sällsten G. 2008. Environ Sci Technol. 42(14):5074-80. Indoor levels of polycyclic aromatic hydrocarbons in homes with or without wood burning for heating

Being declared in nonattainment of federal air quality standards is very serious for any community. It means that not only is the air unhealthy, but also that legal requirements are triggered for states to reduce pollution and meet standards; stricter requirements may be imposed on new and potentially existing industry; and the stigma of "nonattainment" can be a deterrent to attracting new business. Communities declared "nonattainment" face serious public health and economic burdens.

3.5 Cultural practices/perceptions (urban/rural)

Wood burning is a long practiced tradition. With plentiful wood available and a strong culture of woodstove use, wood burning is an inherent part of many Oregonians' lives especially in communities where mills have been plentiful. Mill workers were accustomed to bringing home wood to heat homes. For many families, there are strong memories associated with wood burning and wood gathering. Some remember going out as young children with their parents to gather and chop wood, storing and stacking wood, and making it a family affair. Additionally, children are raised with the warm heat of wood burning, and associate it with warmth and coziness to cut through the wet cold winters.

In the 1970s and 1980s, when the oil crisis was of great concern to citizens, wood burning seemed like an attractive option to get away from dependence upon foreign oil. The Department of Energy fostered this culture by promoting wood heat. There continues to be growing interest in burning biomass to produce heat independent of the grid and to help save money on home heating bills. Using wood for heat is also considered "carbon neutral", so some homeowners might choose it to reduce their impact on climate change.

Other citizens have a negative connotation with wood smoke because in some communities there may be very close proximity of houses and this closeness makes it easier for wood smoke to permeate homes. People with respiratory problems are particularly affected. These dense neighborhoods, whether in urban or rural communities can make it particularly difficult with regards to the prevalence of wood smoke, as opposed to other areas where the nearest neighbor with a wood burning device may be ¼ mile or more away.

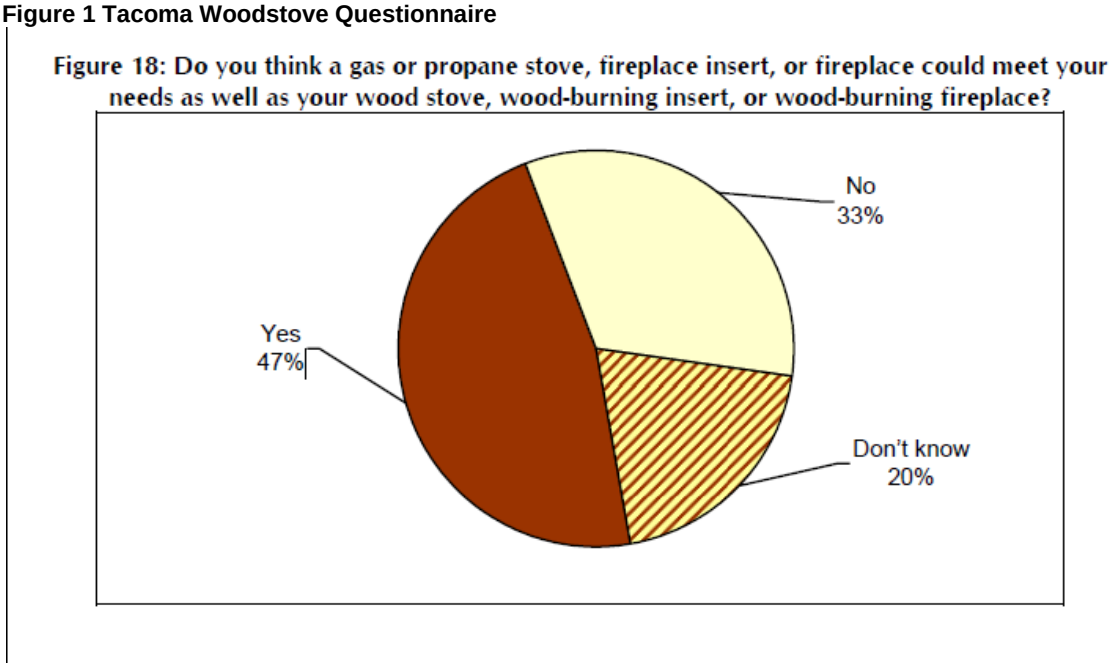
Another challenge regarding wood heat is the type of wood heating device being used. Woodstoves, wood fired furnaces or boilers, and pellet stoves are typically used to heat homes. Conventional fireplaces are highly inefficient, high woodsmoke producing devices not typically designed to be used for heat but more for aesthetic purposes. A typical fireplace can be nearly twenty times as polluting as a certified woodstove and emit 15 lbs/ton more smoke[15]. Many older homes have these conventional fireplaces and oftentimes residents may use them as a heat source in winter.

There are also barriers for people to convert from wood heating to natural gas or electric heating such as ductless heat pumps. In a recent survey conducted in the Tacoma, Washington area, residents who owned a woodstove were asked whether a gas-fired appliance would meet their needs as well as the wood burning device. About half thought it would, with one-third of respondents thinking it would not work as well (Figure 1). The survey also indicated money is a big driver; most people don't want to switch fuel from wood to other alternatives and few can afford a new device.[16]

[15] http://www3.epa.gov/ttnchie1/ap42/

[16] Phil Swartzendruber, Puget Sound Clean Air Agency, Woodstove Retrofit Open Challenge and Testing, presentation to EPA, October 28, 2015.

Figure 1 Tacoma Woodstove Questionnaire



DEQ conducted an informal review of its complaint database and determined there were approximately 43 complaints for 2015 (up through November) regarding woodsmoke. Most of the complaints involved people suspected of burning trash and other wood materials in their woodstove. Over half of the complaints were generated from urban areas, primarily the Portland metro area.

3.6 Weather (cold weather, inversions)

Woodsmoke is particularly prevalent in the winter, when people use wood heating devices to warm their homes. This can become a concern because air quality can often drop to unhealthy levels due to cold weather inversions, trapping woodsmoke near the surface.

Many communities in Oregon are located in valleys or basins and are surrounded by mountainous regions all around or are confined by high ridges and hills surrounding the area. Because of these features, these communities (specifically Klamath Falls, Oakridge, Medford, and Lakeview) can experience very strong and shallow nighttime inversions that break up with daytime solar heating. In the wintertime, frigid arctic air masses frequently move down and sweep through these basins where temperatures can remain below freezing for several weeks at a time. Under these conditions, strong inversions can occur.

Particular challenges arise when very cold temperatures occur. In 2013, Oregon experienced the coldest winter episodes on record for some communities (Klamath Falls, Lakeview). Concurrently, PM2.5 levels across the state were recorded at the highest levels in years, presumably due to the increased use of wood burning devices so residents could stay warm during the winter.

3.7 Unique challenges for communities (natural gas availability, air toxics, low-income)

In addition to the difficulties communities face with regards to a plentiful and available wood supply and a strong culture of woodstove use, there are unique challenges for additional communities. In areas where replacing old uncertified stoves with other non-wood burning devices such as those using electric or gas, there may be no natural gas options available. This is of particular concern for Lakeview and Oakridge, two areas that are

currently violating the PM2.5 standard and have no natural gas availability. This limits options in these communities for using non-wood burning devices on poor air quality days.

Another challenge is that many low-income populations use woodstoves as a primary or secondary form of heat, which means that unhealthy wood smoke is often concentrated in neighborhoods where there are high proportions of low-income and minority populations. These populations often have preexisting conditions that make them even more vulnerable to the effects of air pollution. [17] Low-income residents are less able to afford to replace their uncertified stove and typically find the cost of heating with alternate sources during particularly cold weather events to be too expensive. Many low-income residents are renters in poorly weatherized homes. If their rental home has a woodstove, it is often uncertified, and their alternate heating device may not work well, poorly heating the house. Their alternate heating device may also be so costly to run that the renter chooses the woodstove as the cheaper way to heat the home. Additionally, renters have little control over their choice of heating device and how well it is maintained, particularly if the landlord is negligent or absent.

As mentioned earlier, woodsmoke contains not only PM2.5, but also air toxics such as benzene and PAHs. According to various studies, high concentrations of air toxics exist in most counties in Oregon. The highest concentrations of air toxics are in Multnomah, Washington and Clackamas counties, where population and vehicle use are highest and where there is the most industrial and business activity. Additionally, air toxics at levels of concern can be found anywhere in the state where there are motor vehicles, fuel burning (wood stoves), small businesses using chemicals and larger industrial activities. Some of the contribution of air toxics has been attributed to woodstoves.[18]

4. Types of wood burning devices

4.1 Woodstoves

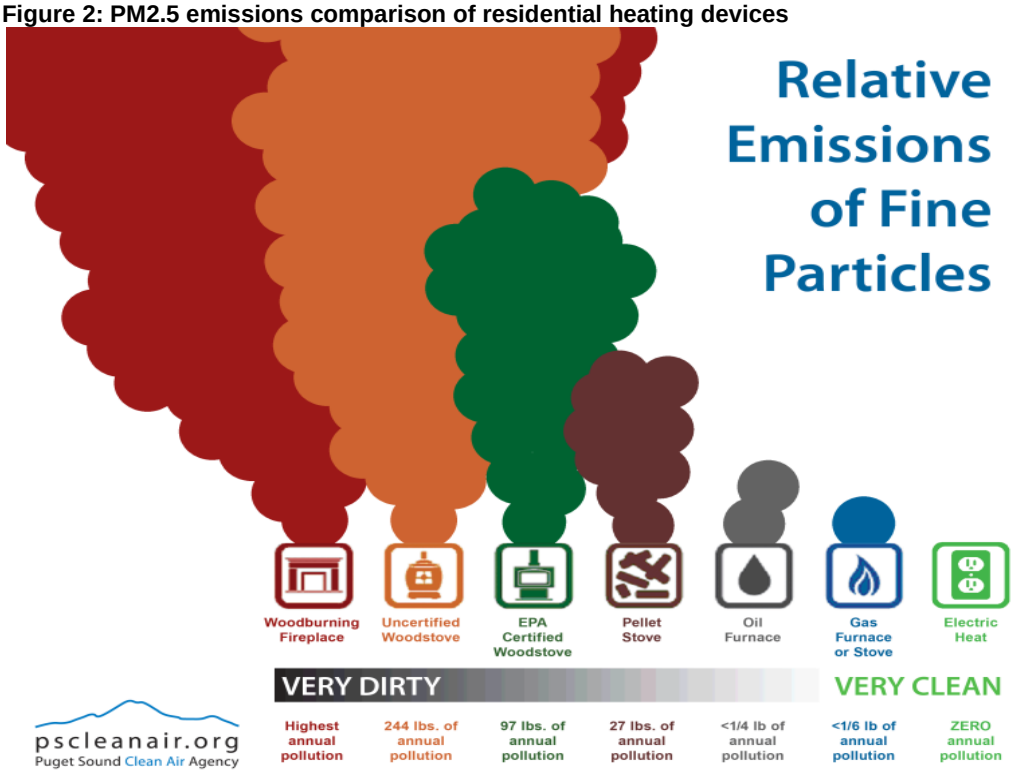
A wood stove is an appliance that is usually made of cast iron, steel, or stone. Wood stoves that burn wood for fuel can be used as a primary or secondary source of heat. Most stoves in homes are not EPA-certified. EPA-certified stoves are cleaner burning and more energy efficient. While a new wood stove, hydronic heater, or wood-burning fireplace will typically pollute less than older appliances when used properly, it is important to emphasize that how a user operates their appliance is equally important in maximizing energy efficiency and reducing emissions.

4.2 Fireplaces

There are two major types of wood-burning fireplaces: traditional masonry fireplaces that are typically built of brick or stone and are constructed on site by a mason, and “low mass” fireplaces that are engineered and pre-fabricated in a manufacturing facility prior to installation. Most fireplaces, whether masonry or low mass, are not used as a primary source of heat; their function is primarily for ambiance. Fireplaces are typically very inefficient heaters with emissions at least 20 times higher than a certified woodstove. (Figure 1)

[17] U.S. Environmental Protection Agency, Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces, 80 FR 13671, March 16, 2015
[18] http://www.deq.state.or.us/aq/toxics/faq.htm

Figure 2: PM2.5 emissions comparison of residential heating devices



EPA has a wood-burning fireplace program that encourages fireplace manufacturers to develop cleaner burning fireplaces for consumers. The voluntary program sets a qualifying emission level for new fireplaces, including pre-manufactured and site-built masonry fireplaces. In communities that allow wood-burning fireplaces in new construction, EPA recommends that homeowners and developers install cleaner-burning, EPA qualified models.

4.3 Wood hydronic heaters (indoor and outdoor wood boilers)

Hydronic heaters, also known as outdoor wood boilers, are used to provide heat and hot water to homes and other buildings. These devices are located outside the buildings they heat in small sheds with short smokestacks. Typically, they burn wood to heat liquid (water or water-antifreeze) that is piped to provide heat and hot water to occupied buildings such as homes, barns and greenhouses. These devices can be a significant local source of smoke. Hydronic heaters may also be located indoors and they may use other biomass as fuel (such as corn or wood pellets).

4.4 Wood forced air furnaces

Wood forced air furnaces are devices that burn wood or pellet fuel that warms spaces other than the space where the furnace is located, by distribution of air heated by the furnace through ducts. Woodstoves typically heat the space surrounding it. In Oregon there are very few (known) wood forced air furnaces.

5. History of woodstoves in Oregon

5.1 Woodstove use in the state (1970s to present)

Early woodstoves were basically cast iron boxes with a combustion chamber and little else. The energy crisis of the 1970s caused a huge surge in their popularity. But the designs were still inefficient, emitted high levels of PM2.5, and were fire hazards due to significant creosote build-up. However, homeowners were purchasing them in great quantities because they could heat their homes with wood and save money at the same time. By the early 1980s, approximately 1 million stoves were sold annually with approximately 450 woodstove manufacturers nationwide.[19] Woodstoves built during this era, known as uncertified woodstoves, are a huge part of the woodsmoke problem in Oregon, as they emit up to 70% more particulate air pollution and 25% more benzene than newer "certified" woodstoves that meet federal emission standards. Smoke from uncertified woodstoves can also affect indoor air quality and create poor air quality both inside and directly outside the home. In the mid 1980s DEQ began to strategize on how to solve this problem.

5.2 Certification standards

In 1986, Oregon established a certification program for woodstoves by requiring stoves to meet emission standards in order for them to be sold in the state. Previous to that, stoves did not have any emission control requirements. By 1988, the U.S. Environmental Protection Agency began requiring certification standards, modeled after Oregon's program. EPA implemented the program in two stages: Phase 1 had to meet certain standards (8.5 g/hr) and Phase 2, implemented in 1990, required noncatalytic stoves to meet 7.5 g/hr and catalytic stoves to meet 4.2 g/hr. In 2015, EPA promulgated updated standards for a broader range of wood heating devices, including many stoves that were previously exempt under the old standards. EPA's new standards required that all wood burning room heaters, including noncatalytic and catalytic stoves, pellet stoves, and single-burn rate stoves to meet 4.5 g/hr, and then 2.5 g/hr in 2020.

5.3 Current woodstove use in Oregon

DEQ currently estimates there are about 591,000 homes with a wood burning device. Approximately 150,000 homes have an uncertified woodstove and 212,000 homes have a fireplace, two of the most polluting devices. In general fireplaces are typically utilized for ambiance heating, (e.g., used only 2-3 times a year), whereas woodstoves are typically used on a daily basis throughout the winter months. DEQ estimates there are about 214,000 homes with certified woodstoves and pellet stoves. Woodstoves are typically used for secondary heat, meaning residents have a primary source of heat such as a natural gas or electric furnace. DEQ woodstove surveys have indicated usage of all wood burning devices at around 17% as a main source of heat and 37% as a secondary source of heat[20].

Nationally, there are approximately 195,000 certified woodstoves, woodstove inserts, and pellet stoves that are shipped from manufacturers to retailers and stores each year[21]. Actual device sales can vary considerably by year, depending upon weather conditions, heating fuel costs, and the economy. Over the past few years, however, it is suspected that wood burning device sales are trending downward, due in part to lower home heating costs associated with natural gas, propane and heating oil.

As another source of information, the US Census Bureau provided a history of wood use as the main source of home heating from 1940 to 2000. Both nationally and in Oregon wood has been the main source of heat in the early 20th century and dropped dramatically in the late 20th century. Nationally, wood was used in the most

[19] Alliance for Green Heat, http://www.forgreenheat.org/resources/history.html
[20] Oregon DEQ Woodstove survey, 2009
[21] Based on a six-year average (2010-2015) of units shipped annually in the U.S.

northern communities to heat homes at roughly 23 percent of the homes in 1940 and dropped to less than two percent in 2000. In contrast, Oregon's wood use for main home heating was 73% in 1940 and has dropped to roughly 7% in 2000.

Figure 3: National use of wood as a main source of fuel for heat for residential heating compared to other main sources of fuel

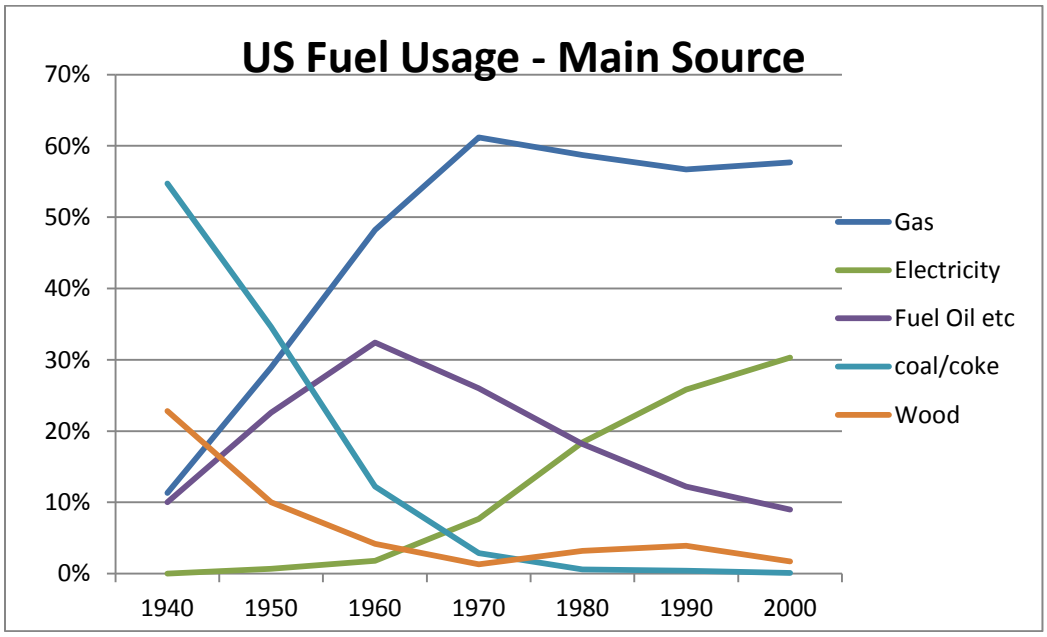
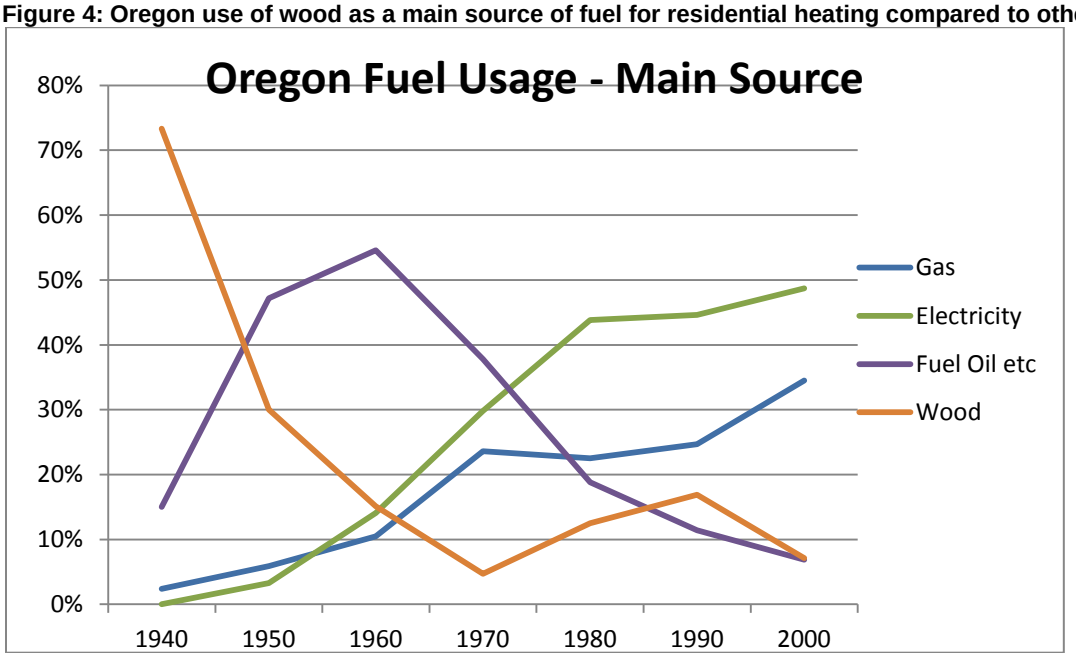


Figure 4: Oregon use of wood as a main source of fuel for residential heating compared to other main sources of fuel



6. Understanding & assessing the effects on communities where woodsmoke is a concern

6.1 Public health effects

Woodsmoke ($PM_{2.5}$ and air toxics) creates serious health problems for Oregonians. The health effects of woodsmoke can result in increased hospital admissions, lost work days, reduced productivity, missed school days, and can put a strain on hospital and medical resources. Residents may have higher medical costs, including prescription drug costs, and lost income because of missed work days or having to stay home to take care of sick children or elderly parents. A study by the Washington Department of Ecology estimated the total cost of PM2.5 diseases from woodsmoke to citizens, businesses, and state healthcare institutions is about $190 million each year.[22]

DEQ often receives requests from people looking to move into an area about the air quality in a particular city. The public health effects of woodsmoke on a community can also serve as a deterrent for people because the air is unhealthy. Fewer people in the community (because of people leaving or not wanting to move there) can result in fewer resources being available because there aren't enough children to populate the local school, forcing them to be bused to a nearby town, not enough people to support local businesses and stores causing them to close, and potentially causing other programs and services to shut down for lack of funding.

6.2 Nonattainment - economic effects

Nonattainment for any community can have serious economic effects. Businesses may not be inclined to locate to the area because of additional requirements imposed upon them for being in a nonattainment area. This can include installing more costly controls to reduce PM2.5 emissions. Other requirements may include extensive modeling of the business' impact on air quality with regard to expansion or siting of a new facility in the area. This assessment can be expensive to conduct, requires time to complete, and delays the building or expansion of the facility.

6.3 Case studies/Real life situations

Klamath Falls is one community that has struggled economically due to the nonattainment requirements. The community has already been negatively impacted by the closure of several wood products mills in town over the past 20 years, and the nonattainment designation makes it even harder for new industry to locate in the area. The shortage of living wage jobs plus the difficulty of attracting new ones makes it more difficult for residents to scrape by. Additionally, all of the city's business districts (including Main Street) are filled with vacant storefronts and two major grocery stores have closed, leaving only a Fred Meyer and Walmart to serve the larger grocery needs for the community.

Prineville is currently violating the standard, but is not yet designated as nonattainment. Prineville is attracting major businesses like Apple, specifically to establish large data storage banks. Data banks such as these are powered by electricity, but these types of companies often install backup generators in case grid electricity is lost, generators that are presumably diesel-fired and emit PM2.5. If the area were to be designated nonattainment, the

[22] Publication number 09-02-021, *Health Effects and Economic Impacts of Fine Particle Pollution in Washington*, Washington State Department of Ecology, December 15, 2009

permits required to operate these backup generators would be even more difficult to obtain depending upon the amount of PM2.5 generated. Additional steps may be required of any large source, including pollution control equipment and modeling to ensure the airshed is not negatively impacted by the business' emissions. These restrictions may make it more difficult for future businesses to consider continued expansion or make it too costly to continue operating.

Lakeview is also struggling with violating the PM2.5 health standard but has not officially been designated as nonattainment. Lakeview is a much smaller town (population 2,300), and within the past few years local businesses have closed along its Main Street, grocery stores have closed leaving only one place for residents to buy groceries, and local restaurants have had to close intermittently due to economic reasons. If any other major employer shuts down and unemployment climbs, the economics, social, and health of the community would plummet further. The survivability of borderline retail stores would diminish, as well as quality school and financial survivability of the newly constructed hospital. Initially less obvious would be the overall effects to social and to mental and physical health of citizens, in addition to and compounding the health effects of poor air quality. Unemployment and poverty-related lifestyles diminish self-esteem, leading to various social and mental health issues, and diminish affordability of healthy food and healthy eating habitats, which thereafter promotes other physical health issues, in addition to effects of poor air quality.

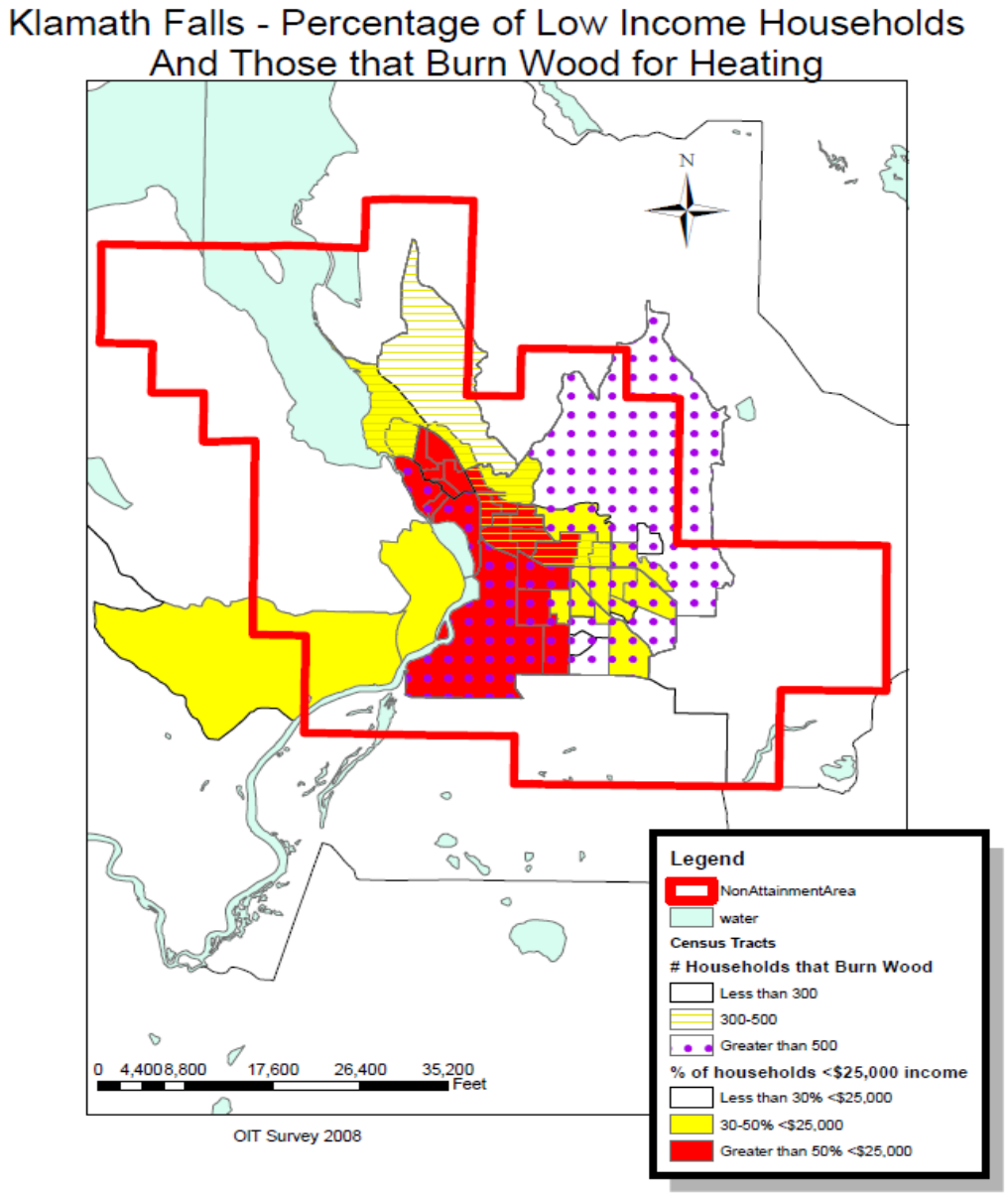
6.4 Transportation projects

A nonattainment designation can mean the loss of federal funds for transportation projects, such as highway and road expansion. It can also mean significant delays to any planned project because of the additional requirements that must be applied before construction can begin. For example, when Klamath Falls was designated nonattainment in 2009, a major transportation project, the Washburn Way overpass, was delayed for approximately two years because of conformity requirements.

6.5 Environmental justice

Many low income folks burn wood and are affected by wood smoke pollution. People living in lower socioeconomic conditions are at greatest risk from PM2.5 exposure because they may not have resources (financial or knowledge) of how to improve their circumstances.[23] In this case, communities could be affected by woodsmoke around them and by the smoke they are generating. Low income residents often use uncertified wood stoves to heat their homes, putting their own health and risk, and even if they don't have a woodstove, they may be disproportionately located in neighborhoods where heavy woodstove use occurs.

[23] U.S. EPA, Office of Air Quality Planning and Standards "Strategies for Reducing Residential Woodsmoke", Publication No. EPA-456/B-13-001, March 2013, p. 5



7. Current Woodsmoke Reduction Programs & Funding

There are a variety of programs to address residential wood smoke, including regulatory, voluntary, and educational measures. These programs range from short term actions such as woodstove curtailment programs where restrictions are placed only during the winter months for immediate reductions in woodsmoke levels, to longer term actions such as woodstove changeout programs that take time to implement and provide a small, yet modest reduction over the years as stoves are changed out.

Some of these programs can be very resource intensive, requiring funding and administrative oversight (such as covering the administrative costs of running curtailment programs to providing financial incentives to households

to replace or retrofit old appliances); whereas other programs can be implemented with minimal costs. There are also unique challenges in acquiring funding and meeting the requirements of the funding agencies. These challenges require a new approach to securing, obtaining, and distributing funding that makes it easier for the homeowner or local government to address the woodsmoke problem.

7.1 Woodstove curtailment

One relatively inexpensive and very effective strategy to reduce wintertime wood smoke is through a woodstove curtailment program. Curtailment programs can be either voluntary or mandatory depending upon the severity of the air quality problem and available resources. In some communities in Oregon where air quality is of concern but the area is not violating the standard there are voluntary wood smoke curtailment programs coupled with a public awareness program. In other communities where residential wood smoke continues to impact air quality causing the area to violate the PM2.5 standard or be close to violating the standard and the community wants to ensure it does not become a nonattainment area, then a mandatory program may be in place. Generally, mandatory curtailment programs prohibit the use of wood stoves and other devices under certain circumstances. Other provisions may be implemented including exemptions for low income residents or households that do not have an alternate heating source (i.e., sole source residences).

Curtailment programs are often color-coded to make it easier for the public to understand what restrictions may be in place. A “yellow day” may allow EPA-certified wood stoves to operate, and a ‘red day” may ban the use of all wood-burning appliances except for pellet appliances, as pellet stoves tend to burn cleaner throughout their burn cycle and cannot be loaded with unseasoned wood, like wood stoves.

Although curtailment programs are not always popular with the public, this measure can be highly effective at reducing wood smoke and has been successfully implemented in a number of communities. For many years Lakeview implemented a voluntary curtailment program, until the 2014-15 heating season when a mandatory program was put into place. Under the voluntary program there was roughly a 23% reduction on days where the monitor recorded PM2.5 levels above the standard, whereas under the new mandatory program there was a 71% reduction.

At least 10 Oregon communities have curtailment programs (voluntary or mandatory) and public education and outreach programs in place. Some of them are nonattainment or maintenance areas for fine particulate pollution (PM10/PM2.5) and others are communities struggling to stay below the PM2.5 standard.

7.1.1 Klamath Falls

In Klamath Falls, a designated nonattainment area, local ordinances were passed establishing a mandatory curtailment program with very strict levels in which red and yellow days would be called. For example, a red day, when no burning in any wood fired device is allowed, is called when levels of PM2.5 are expected to reach 30 ug/m3, 5 ug/m3 lower than the actual level of the standard where adverse health effects are experienced. Yellow days, when only burning in certified wood stoves and pellet stoves is allowed, are called when levels are expected to reach 25-30 ug/m3. This results in more red and yellow days to ensure the area’s air quality stays clean and does not violate the standard. Klamath Falls is obtaining an 85% reduction of monitored days above the standard by using their mandatory program. Klamath Falls does provide exemptions for low income households, wood stove as sole source of heat households, and if the woodstove being operated was a result of the recent changeout that has occurred in the past few years. A violation of the curtailment program has resulted in fines of $650.

7.1.2 Oakridge

Oakridge, another nonattainment community has a mandatory curtailment program in place. Its program is exactly the same as the one in Klamath Falls, with advisories being called at levels lower than the standard. There

are also requirements to meet opacity[24] where no woodstove can emit more than 20% smoke. Violations of the curtailment program can result in fines of up to $500.

7.1.3 Lakeview

Lakeview until last year had a voluntary curtailment program. Levels within the past few years began to rise and the area was found to be violating the standard, with 2013 being a very high year with levels as high as 99 ug/m3. Although EPA has not designated the area as nonattainment, Lakeview took steps to bring levels down and instituted a mandatory program for the 2014-2015 woodheating season.

7.1.4 Medford

The Medford and Jackson County region implements a mandatory woodstove curtailment program very similar to the Klamath Falls and Lakeview programs. The Medford area has had a long history of dealing with woodstove issues, ever since it was designated a nonattainment area for PM10 back in the 1980's. Since then, Medford has been in compliance with the PM10 standard and has continued to keep its particulate levels below the PM2.5 standard.

7.1.5 Eugene

The Eugene area has a mandatory woodstove curtailment program similar to the other areas. The Eugene area also has a long history of dealing with woodstove issues, ever since it was designated a nonattainment area for PM10 back in the 1980's. Since then, Eugene has been in compliance with the PM10 standard and has continued to keep its particulate levels below the PM2.5 standard. The curtailment program in that area is administered by Lane Regional Air Protection Agency.

7.1.6 Hillsboro/Washington County

Recent data for the Hillsboro area indicated that pollution levels were approaching the PM2.5 standard. Concerned about potentially violating the standard and being declared nonattainment, the City of Hillsboro (and unincorporated Washington County) adopted in 2015 a mandatory woodstove curtailment program, which is being implemented beginning in the 2015-2016 wood heating season.

7.1.7 Prineville

Monitoring data in Prineville indicates its PM2.5 levels are above the PM2.5 standard. While not designated as a nonattainment area, Prineville is implementing a mandatory open burning program with a public education program on open burning and burning cleanly in wood stoves to bring its PM2.5 levels down.

7.1.8 Burns and Pendleton

Burns and Pendleton are communities where levels were very close to approaching the PM2.5 standard. Pendleton is conducting a mandatory woodstove curtailment program and Burns is conducting a voluntary program but also does public education through a school flag program, where local schools display red, yellow, or green flags during the winter wood heating season to indicate wood burning advisory status for the day.

7.1.8 Grants Pass and La Grande

Grants Pass and La Grande are former PM10 nonattainment areas that have historically had PM air quality problems. As part of their strategy to ensure continued compliance with PM, Grants Pass implements a mandatory curtailment program and La Grande implements a voluntary program.

7.1.9 Estimated Costs

Administering a curtailment program requires many resources because of the need for someone to review meteorological data and issue daily advisory calls during the winter months. This also includes notifying the public and responding to inquiries. Some programs include an enforcement and assessment component, where a

[24] Opacity means how much your view through the smoke is blocked.

staff person is driving around the community during the day and evening to see if people are complying with the program, to following up on potential enforcement actions and disseminating information. Because of this level of involvement funding is critical for its success. Some of these communities receive funding from DEQ to implement their local air quality programs, whereas others receive no funding at all and must rely on their own source of funding to fully implement their programs. DEQ's funding is based on its budget, as determined by the Oregon Legislature and currently receives $85,000 a year to distribute to all communities, with the average cost to implement a program between $25,000 - $75,000 a year for each community. In addition to community funded contracts with local governments, DEQ provides staff support for local meetings and technical assistance in various communities. DEQ involves various people from technical staff, public relations staff and management staff to help communities weave through the federal and state regulations for local communities and provides roughly 2.5 FTE for this work. Should an attainment plan or maintenance plan need to be developed, DEQ provides up to 4 FTE for this work.

Table 1: Estimated Yearly Costs per Community to Implement their Current Woodstove Curtailment Program

Community	Estimated Costs per year[25]	Funding Source
Klamath Falls	$55,000	DEQ and local funding
Oakridge	$57,000	LRAPA, DEQ, and local funding
Lakeview	$25,000	DEQ and local funding
Prineville	$15,000	Local funding and DEQ
Washington County / Hillsboro	$50,000 (Washington County) $15,000 (Hillsboro)	Local funding
Eugene	$6,800+[26]	LRAPA, DEQ, and local funding
Medford	$30,000	DEQ and local funding
Burns	$10,000	Local funding (from Burns, Hines, Burns-Paiute Tribe)
Pendleton	$15,000	Local funding
Grants Pass	$18,000	DEQ and local funding
La Grande	$10,000	Local funding
TOTAL	$258,800	

Funding for local air programs (both DEQ funding and local funding from timber revenue) has been falling for over a decade. Local funding has been little to nonexistent for years. Klamath Falls, Oakridge, Lakeview, and Prineville are violating PM2.5 standards and must meet Clean Air Act deadlines for restoring healthy air quality. Without continued or additional assistance, there is a real possibility that these programs will start coming back to the state for implementation, which would be very inefficient and much more costly. Increasing the funding amount would ensure these local curtailment programs could continue.

7.2 Woodstove changeouts

Woodstove changeouts are ways that homeowners can replace old wood burning devices such as uncertified woodstoves and fireplaces with cleaner burning heating devices. Woodstove changeout programs are most effective when they also include education and outreach to ensure households burn more efficiently and cleanly. Wood stove replacement programs address both indoor and outdoor air quality, reduce fine particle and toxic air

[25] Based on 2015-2016 budget. These costs can fluctuate from year to year, depending on the nature of the program each community is administering. In particular if a community must develop an attainment plan or maintenance plan, then costs will be higher because of the increased level of involvement required (e.g. advisory committees). Additionally, some of these costs may reflect salary for an enforcement officer, public outreach, etc. whereas other community estimates may not reflect this.

[26] LRAPA estimates it costs about $1133 per red day event. For the current 2015-2016 season, there were six red days called, although it is likely this number will be higher if there are more red days called for the Eugene area.

pollution, improve energy efficiency, and reduce the risk of chimney fires. Changing out one old dirty, inefficient wood stove is equivalent to the PM2.5 pollution reduction of taking five old diesel buses off the road.[27]

Oregon has been conducting woodstove changeouts since the 1980s when many areas of the state were violating the standard due to woodstove smoke, primarily from uncertified woodstoves. While many stoves have been replaced in the past 30 years, there are still approximately 150,000 uncertified stoves remaining. Within the past few years, there have been numerous programs helping specific communities to changeout old stoves, particularly in areas that struggle to meet the federal PM2.5 health standard.

Changeout funding, however, is the biggest challenge in implementing changeout programs because of large dollar amount needed to change out the stoves. While the cost of purchasing a new device may run between $1500 for a new certified woodstove to $3000 for the purchase of a new electric ductless heat pump, it is often the installation that can double the cost, making the total cost of a full changeout and installation between $3000 to $5000. Adding to the expense is often a need to weatherize the home to ensure the heating device will work at its optimum efficiency. Because DEQ estimates there are approximately 150,000 homes with an uncertified device, changing out every stove in Oregon would cost at least $450 million to $750 million not including administrative costs just to implement the program. The local nonprofits and local communities who often implement these changeouts are often cash strapped and need administrative funding to operate the programs.

Despite the significant cost to replace woodstoves, even a few million dollars over a number of years in communities can make a significant contribution to eliminating the old uncertified devices with cleaner burning heating alternatives. The communities of Klamath Falls and Lakeview have seen over $2.5 million in woodstove changeouts distributed, however this has all been one-time funding. In contrast, the State of Washington provides a sustained funding source for woodstove changeouts to Washington State Department of Ecology to distribute to communities in need. Over $9 million has been allocated to woodstove changeouts[28] for the past nine years, resulting in almost 4,000 uncertified stoves removed. Sustained funding for all communities would ensure changeouts can occur throughout Oregon on a regular basis in those communities most in need as conditions change over time.

7.2.1 Oregon examples

7.2.1.1 Warm Homes Clean Air program

The Warm Homes Clean Air program, run by the Lane Regional Air Protection Agency (LRAPA), was funded by 11 partners. The program not only included a woodstove buyout program but also a weatherization and home repair program. Partners included woodstove dealers that offered rebates on new stoves, St. Vincent De Paul which provided over $400,000 toward weatherization/ home repair from a grant, as well as state and local housing agencies who provided services. Through this effort, residents were offered a tailored set of options designed specifically for them using a single application form, eliminating the need for residents to search for available funding programs. Rebates were provided - $2,500 for oil or propane, $2,000 for a pellet stove, and $500 to change out a certified woodstove to pellet, oil, propane or electric.

7.2.1.2 ARRA program

In 2009, Oregon DEQ secured $2 million to conduct woodstove changeouts. The funding came from the Oregon Department of Energy's State Energy Program and it was part of 2009 American Recovery and Reinvestment Act funding. Through this program, DEQ replaced 695 woodstoves in three different areas of the state. The goal of the program was to replace old woodstoves with the new, more efficient wood burning devices or electric and gas heating units.

[27] U.S. EPA, Office of Air Quality Planning and Standards "Strategies for Reducing Residential Woodsmoke", Publication No. EPA-456/B-13-001, March 2013, p. 13

[28] Some of this funding was also allocated for woodstove bounties.

DEQ partnered with local agencies and organizations to administer the funds in the following areas:

- Springfield/Eugene and Oakridge, rebates were administered by Lane Regional Air Protection Agency (LRAPA),
- Klamath Falls and Lakeview, rebates were issued by the South Central Oregon Economic Development District (SCOEDD), and
- Burns and Hines, rebates were issued by Harney County Senior Center on behalf of the Harney County.

The program offered either partial or full rebates. Partial rebates were based on the energy efficiency and emission reductions from the new heating system, with the largest rebate given for electric and natural gas systems and smaller rebates for wood and pellet stoves. In Eugene and Springfield, as an extra incentive for homeowners to changeout their uncertified devices to premium efficiency ones, Lane Electric also offered an additional rebate for the installation of any electric heat pump. Full rebates were offered to low-income homeowners providing up to $5,000 for a heating system replacement.

7.2.1.3 Regional Solutions Team

The regional solutions advisory committees and teams around the state can help communities that exceed the federal health standard for fine particulates. Often the regional priorities set by the regional solutions advisory committees include priorities to address nonattainment issues and/or to promote business retention and expansion. In cases like these, the regional solutions teams can assist communities to develop projects that help reduce the residential woodsmoke. However, the key to success is community leadership in concert with regional solutions assistance. This team approach can help keep solutions local, as opposed to federal.

A number of regional solutions projects have been completed and some are currently underway. These include a full suite of options for residents in the following communities that encompassed changeouts from uncertified stoves to new certified stoves with very low emissions, pellet stoves, and heat pumps, weatherization, public education, and coordination with other agencies to obtain additional incentives (through Energy Trust of Oregon and Oregon Department of Energy):

Table 2: Regional Solutions Woodstove Changeout Programs

Program Elements	Funding
Lakeview woodstove and weatherization (2013)	
• 51 homes changed out uncertified wood stoves for new certified wood stoves that emit no more than 1.5 grams per hour • 43 homes weatherized	• $233,000 - Oregon Department of Energy (one-time grant) • $100,000 – Oregon Health Authority (one time grant) • $82,000 DEQ Special Environmental Project Funds (related to a fine) • Above funding leveraged with existing ongoing incentives from Energy Trust of Oregon and Oregon Department of Energy (generally $1,000-$1,500 per home)
Klamath Falls and Chiloquin woodstove and weatherization (2014)	
• Klamath Falls – 67 homes changed out uncertified wood stoves for non-wood heating systems (heat pump or gas) • Chiloquin - 21 homes changed out uncertified wood stoves for new heating systems (certified wood stoves that emit no more than 1.5 grams per hour, pellet stoves and 2 heat pumps).	$400,000 through Special Environmental Project (one-time funding)
Klamath Falls and Lakeview woodstove and weatherization (2015)	
• Ongoing - Over 100 homes in Klamath Falls and 100 homes in Lakeview to change out uncertified wood stoves preferably with non-wood heating systems or pellet stoves.	• $1,500,000 Regional Solutions Funding (one-time grant), split 50/50 between the areas • 25% of funding to be used for weatherization
Prineville changeout and weatherization (2015)	
Currently in progress	• USDA Rural Development 504 Loan/Grant Program • Available statewide - first come, first served • Improvements would be critical health/safety items, including heating system changeouts and weatherization. • Grants up to $7500 per home for qualifying low-income seniors in owner-occupied homes. • Up to $20,000 loans (1% up to 20-year terms) for qualifying low-income owner-occupied households. • Cascade Natural Gas – available first come-first served • Central Electric Coop – Added ability to fund 100% of a new electric heating system

Many of these funds were leveraged with in-kind contributions from other state agencies and incentives. This enabled the changeout programs to be even more effective when coupled with weatherization funds or energy incentives to help stretch project dollars and provide as many services as possible to the homeowner. Table 1 shows how incentives were utilized to leverage and stretch project funding for woodstove changeouts
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Table 3: Woodstove changeout incentives used to leverage project funding

INCENTIVES USED TO LEVERAGE AND STRETCH PROJECT FUNDING **Note: Energy Trust of Oregon (ETO) used in this example. Other utility territories have different incentives.**				
Heating System Type	**2015 Numbers – Subject to Change Because Numbers Updated Annually**			
	OHCS, USDA-RD, & Gas Company Administered Programs *(Low-income)*	ODOE Tax Credits *(Apply to All Income Levels)*	Energy Trust of Oregon (ETO) **Territory** *(Above Low-income)*	
			ETO Savings Within Reach *(Moderate Income)*	ETO Standard *(Above Moderate Income)*
Gas Furnace	**OHCS** - Amount of contribution for each household varies, depending on project scope, ownership of utility, and primary heating fuel type **USDA-RD –** Especially the Home Repair Loan and Grant 504 Funding. Amount and ratio of grant to loan for each household varies, depending on household eligibility. **Gas Companies –** Amount per household varies, depending on program offered and household eligibility.	$352 - $492, depending on energy efficiency	$550*	$500 for single family rental dwellings
Direct Vent Gas Fireplace		$550*	$350* (full range is $250 - $350)	$350* (full range is $250 - $350)
Ducted Heat Pump (Upgrade from existing electric resistance heat)		$340 - $1,125, depending on HSPF**	$750 - $1,000, depending on HSPF**	$450 - $700, depending on HSPF**
Ducted Heat Pump (Upgrade from existing wood, oil, propane, or existing heat pump)		$340 - $1,125, depending on HSPF**	$550 - $800, depending on HSPF**	$250 - $500, depending on HSPF**
Ductless Heat Pump (mini-split)		$1,000 - $1,300, depending on HSPF**	$1,000, replacing existing electric resistance heat	$800, replacing electric resistance heat
Pellet Stoves		$288	N/A	N/A
Certified Wood Stove		Tax credit of $144 (non-catalytic) & $216 (catalytic)	N/A	N/A
Weatherization		$250 for duct sealing	Increased cash incentives available and vary, depending on type and amount of improvement	Cash incentives available and vary, depending on type and amount of improvement
Weatherization – SHOW***		Rebates for 50% of cost up to $500, depending on measure available through SHOW Program *** for wood, oil, pellet, or propane	N/A	N/A
		NOTE: Other ODOE tax credits and ETO incentives are available for geothermal and solar heating systems, as well as other items such as water heaters, wind energy, etc.		

*This figure is the highest end of established range due to the project mandate for a minimum of 93% efficiency.
**HSPF – Heating Season Performance Factor.
***State Home Oil Weatherization Program.

7.2.1.4 Revolving loan fund for wood stove changeouts (Pendleton)

The City of Pendleton used funds from a Housing and Urban Development (HUD) Community Development Block Grant to provide initial funding for the purchase of new stoves. The money was then paid back by households that participated in the program. City contributions provided additional funding. Several programs have been implemented in Pendleton including one in which the property owner obtains a $3500 interest free loan and a lien is placed on the property pending repayment. The full principal amount of the loan is due at the sale of the home. Approximately 135 wood stoves have been changed out over the course of the program. The city of Pendleton plans to expand the program by authorizing an annual budget of $25,000 per year from city funds

7.2.2 National examples

Besides Oregon, a number of other communities throughout the U.S. have also implemented programs. One of the biggest and most successful changeout programs occurred in Libby, Montana. In 2005, Lincoln County, Montana first provided low-income homes full replacement costs (which averaged $2,900) to upgrade to an approved cleaner-burning appliance, typically an EPA-certified wood stove. For other community members with an old wood stove or wood furnace, the County provided vouchers up to $1,750. The Hearth, Patio and Barbecue Association (HPBA), along with retailers and manufacturers, worked with organizations to provide discounts for wood stove changeout campaigns. In the past, industry discounts ranged between 10 to 15 percent off the price of a cleaner-burning appliance. The goal was to encourage all households to voluntarily replace their old wood stoves with cleaner-burning technologies to address the county's particle pollution challenges. It served as an informal model for other programs, including that in Oregon.

A number of other different states, including Alaska, California, Colorado, Idaho, Maine, Maryland, Nevada, New Hampshire, New York, Utah, Vermont, and Washington all have various changeout programs in effect. These programs range from replacing old uncertified stoves to open fireplace hearths with certified woodstoves, pellet stoves, and other EPA certified devices or gas appliances. Costs of appliances covered ranged from $100 for fireplace retrofits to $3000 for replacement devices. Program recipients also included low-income eligible households. For more information about each of these programs, please go to:
http://www.woodstovechangeout.org/index.php?id=42

Funding sources for all of these projects have been provided in a number of ways, including state and federal monies (a combination of one-time grants and sustained funding), and federal loans. The following programs list additional sources available:

7.2.2.1 LIHEAP, Dept of Ag – Rural Housing

This program is a Federally-funded program that helps low-income households with their home energy bills. The local LIHEAP program determines if a household's income qualifies for the program. LIHEAP may offer one or more of the following types of assistance:

- Bill payment assistance;
- Energy crisis assistance;
- Weatherization; and
- Wood stove energy efficiency upgrades, repairs and replacements.

The Department of Agriculture, Rural Housing Repair and Rehabilitation Loan and Grant Programs enable low-income, elderly (62+) households to remove health and safety hazards from their homes. Changing out old or improperly installed wood stoves may be eligible under this program. Funding availability is determined by the local service center.

7.2.2.2 HUD block grant

Several programs provide funding for woodsmoke mitigation, such as

- Indian Housing Block Grants: Tribes have discretion to use these funds on most housing related projects. Wood stove changeouts are an eligible activity for low-income households
- Rural Housing and Economic Development Program: This program provides support for innovative housing and economic development activities in rural areas. Eligible applicants are local rural non-profits,

community development corporations (CDC's), federally recognized Indian tribes, state housing finance agencies (HFA's), and state community and/or economic development agencies.

- Indian Community Development Block Grants: This program funds a variety of community development activities, including wood stove changeouts as part of "housing rehabilitation".

7.2.3 SEP

Settlement agreements for violation of federal and state environmental laws may include Supplemental Environmental Projects (SEPs) and/or mitigation projects. SEPs used to implement a wood-burning appliance replacement/retrofit program are an effective way to leverage resources and significantly improve public health and the environment. These types of projects can be used to address various types of pollutants including PM2.5, carbon monoxide, volatile organic compounds, and hazardous air pollutants (i.e., air toxics). Over the last six years, state and federal settlement agreements have included more than $680,000 for wood-burning appliance smoke reduction efforts. The projects ranged from complete removal and replacement grants, providing no-interest loans for purchasing a new stove, a bounty program, to education and outreach.

Table 4: Supplemental Environmental Projects to Address Woodsmoke

Community	Year	Amount	Results
Klamath Falls	2015	$1,560	Billboards, Weather data
Bend	2015	~$1,000	Bounty Program
Columbia, Clatsop, Tillamook Counties (CAT	2015	$12,480	Wood stove replacement for low-income
Columbia, Clatsop, Tillamook Counties (CAT)	2015	$82,000	Wood stove replacement for low-income
Chiloquin	2014	$106,200	21 uncertified woodstoves replaced with certified or non-wood burning devices
Klamath Falls	2014	$333,800	66 stoves removed replaced with non-wood burning devices
Lakeview	2013	$1,920	Various Projects
Klamath Falls and Lakeview (SCOEDD)	2013	$6, 198	Various Projects
Lakeview	2013	$82,400	Woodstove Changeout to efficient certified stoves
Klamath Falls	2012	$3,520	Various projects
Pendleton	2012	$8,212	Woodstove Revolving Fund Changeout program
Klamath Falls and Lakeview (SCOEDD)	2011	$3,800	Various projects
Harney County Sr Center	2011	$27,520	Woodstove Changeouts
Klamath County	2011	$3,200	Public Education
Klamath Falls (SCOEDD)	2011	$5,120	For Woodstove changeouts
Pendleton	2010	$8,537	Educational Materials – Sunridge Elementary School and woodstove changeouts

7.3 Education and outreach

Woodsmoke education has always been an important component in reducing PM2.5. Raising awareness, engaging the public, and giving them the tools to make informed decisions about what they burn and how they burn can result in reduced woodsmoke emissions in the community. With proper burning techniques and well-seasoned wood, emissions (even in older wood-burning appliances) can be significantly reduced.

Funding sources include:

- State tax – In Washington State, a sales tax of $30 is tacked on to any newly purchased wood burning device (woodstove, pellet stove, and fireplace). This funding (approximately $150,000/year) is distributed amongst the seven local air agencies for woodburning education and enforcement.
- Supplemental Environmental Projects have also been used to fund education efforts, such as reader boards for curtailment calls, school supplies, school education materials, public awareness materials, night vision equipment, billboards, newspaper ads, and web-design.

7.4 Heat Smart program

Oregon is the only state in the nation to require the removal of an uncertified stove at the time of home sale. Any uncertified stove on the property must be removed. Requiring old stove removal at the time of home sale helps benefit public health in the neighborhood by reducing air pollution from that home, accelerates the turnover of old, uncertified stoves, and improves home safety by replacing old, potentially unsafe stove installations.

7.5 Bounty program

One way of eliminating old uncertified stoves is to offer a bounty for any stove turned in. Beginning in 2002, the Bend area started a program, the Bend Clean Air Buy Back Program and offered $150 to citizens who brought in a receipt for the destruction of an uncertified stove. In 2004, the amount increased to $200 per stove. The program relies on SEP monies to determine how many stoves can be replaced under its program. Since the program's inception, over 110 stoves have been turned in.

Recently, a number of states have offered such programs or "woodstove roundups", such as the Washington State Department of Ecology. In Winthrop, Washington stove owners were offered up to $250 for turning in an old wood stove. A total of 69 stoves qualified for the program and all were disposed and recycled.

7.6 Opacity and visible limits

To help control smoke from chimneys or flues, and to encourage cleaner burning techniques, some states and localities have laws or rules that require no "visible emissions" or that limit the opacity of emissions. "Opacity" measures how much your view is blocked by smoke. One hundred percent opacity means you are not able to see anything through the smoke. At 20 percent opacity, there is very little smoke and you can see almost perfectly through it. A well-controlled wood-burning appliance will have less than 20 percent opacity and typically no visible emissions. Burning dry seasoned wood in newer technology wood-burning devices will typically limit visible emissions. Prohibiting "visible emissions" means no smoke should be seen coming out of a chimney for a given amount of time. If smoke is seen, it could be considered a violation.

Klamath Falls and Oakridge recently adopted an ordinance requiring 20% opacity from residential fireplaces. Jackson County requires 50% opacity from residential fireplaces. Part of the challenge in implementing this requirement however, is training staff to be able to conduct opacity readings and having the resources to deploy staff to do the opacity readings.

7.7 Wood moisture content

Wood that is not properly seasoned will burn less efficiently and release more harmful pollutants. To increase the likelihood that stove owners will burn seasoned wood, some air pollution control agencies have encouraged the use of wood moisture meters. Puget Sound Clean Air Agency in Washington sends wood moisture meters to community members. Households may purchase a basic wood moisture meter at woodworking specialty shops or online for less than $25. Some areas deem it illegal to sell, advertise or supply wood unless the wood moisture content is 20 percent or less. Klamath County requires wood moisture meters at all homes that have exemptions. Each exemption requires wood moisture content below 15%.

7.8 Uncertified stove bans

For areas that do not meet the national particle standards due in part to woodsmoke, the local jurisdiction may consider banning the use of non-EPA-certified wood stoves. In Libby, Montana, after an extensive woodstove changeout program (see above), the area passed a regulation that banned the use of non-EPA-certified wood stoves. The local government decided that each home using a "Solid Fuel Burning Device" (e.g., wood stove or fireplace) must have an operating permit. Only households that owned a certified wood stove were issued permits. To enforce the regulation, Lincoln County air program personnel periodically look for visible emissions from chimneys. If there are visible emissions and the household does not have an operating permit, the county may issue a notice of violation for failure to have a permit.

In Tacoma, Washington an area designated nonattainment for the daily PM2.5 standard, they also passed an ordinance banning the use of uncertified woodstoves. As of October 1, 2015, it is illegal to own or operate an uncertified wood stove in the Tacoma-Pierce County Smoke Reduction Zone. The new rule requires any wood stove that is not EPA certified to be removed and recycled, or rendered inoperable. The only exception is if the resident has an approved exemption for having no other adequate source of heat in the home.

7.9 Wood bank exchange or community wood bank

A community wood bank provides heat to residents in need by converting trees into firewood. Wood banks are often sponsored by local government or run by volunteers in which cut wood can be placed in reserve for the winter heating season. Once firewood has reached acceptable moisture content it is made available to residents in need of heating assistance. Depending upon the program, the participant can fill out an application to receive wood or can bring in freshly cut wood and exchange it. In Oakridge, the Southwest Forest Collaborative (SWFC) conducted a community firewood program in 2015, offering one cord of seasoned firewood per household at a reduced rate based on household income.

7.10 Heating fuel assistance during poor air quality days

For the community of Oakridge, Lane Electric Cooperative is offsetting the electrical heating costs for residents during poor air quality days. Homeowners who qualify for the program must be a part of its Member Assistance Program (needy family, fixed-income senior, or disabled person) and have a ductless heat pump in the home. The program makes the cost of using the heat pump effectively free on declared "red days" to encourage less wood burning. There are approximately 1400 homes in Oakridge and an estimated 30% depend solely on electric heat. Costs for the program would run on average $10-$15 a day per household, totaling $4,500 for each red day. Over time as more homes are outfitted with ductless heat pumps and are weatherized (under current efforts in Oakridge) the cost for daily offsets should decrease per household.

7.11 New construction restrictions

Some areas may choose to reduce or prevent further degradation of air quality by banning the installation of any wood-burning hearth appliances in new construction, or restricting the number and density of new wood-burning appliances in a given area.

7.12 Fireplace requirements

Over 29 million wood-burning fireplaces exist in homes throughout the U.S., with approximately 212,000 of them in Oregon. Fireplaces are not typically designed and built to be used for primary heating although in some instances they are. Fireplaces can be very polluting; in some areas such as the San Francisco Bay Area, they can represent as much as 75 percent of the pollution from wood-burning devices on bad air quality days.

EPA has a voluntary wood-burning fireplace program that qualifies new, cleaner-burning fireplace models and retrofit devices for existing fireplaces. Where fireplaces are allowed in new construction, EPA recommends the installation of only EPA-qualified, Phase 2 units. If installed and operated properly, EPA-qualified fireplaces can reduce air pollution by approximately 70 percent. For example, as of January 2013, Klamath Falls only allows fireplaces that emit less than or equal to the Phase 2 emission level of the EPA wood-burning fireplace program in all new housing construction.

In the San Francisco Bay Area, air officials have banned all wood-burning devices, including EPA-certified devices in new construction, effective Nov. 1, 2016. Currently, only open hearth fireplaces in new buildings are banned.

7.13 Wood combustion surveys

Collecting information on wood burning (e.g., number of stoves and fireplaces, amount of wood burned) can be a key factor in assessing, evaluating and determining the nature of the woodsmoke problem in the community and provides a way to build an effective program.

7.14 Mobile monitoring

Mobile monitoring is another way to investigate PM2.5 levels in a community. It is not an EPA-approved method to determine compliance with the federal standard but more of a tool to help assess PM2.5 levels in different areas, particularly if there is only one monitor used to determine compliance. It helps determine if there are specific “hot spots” where levels may be higher than in other parts. While mobile monitoring can help obtain more information about PM2.5 levels in specific areas and can provide information about short-term exposures in the area, there are challenges with this approach. There is often a great deal of variability associated with this type of monitoring, quality control can be difficult, and conditions may vary on a daily basis in each of the locations impacting the results.

7.15 Woodstove retrofits

Woodstove retrofits potentially offer a more affordable solution to address smoke from old uncertified woodstoves. Instead of having to spend up to $5,000 for the cost of replacing and installing a new heating device, a retrofit could be installed on the current woodstove (uncertified) at a fraction of the cost (estimates of $100-$200). However, very little research has been conducted, and there are still limitations to this approach: they can be expensive to purchase; they require significant care and maintenance; and they can have significant technical limitations that render them ineffective, unreliable, or hazardous. Puget Sound Clean Air Agency recently conducted a woodstove retrofit challenge to compare and assess reduction results from these devices. In pilot

testing conducted there were results of 70-90% reduction. The testers did caution that more testing was necessary to fully see what the results would be.

7.16 Tax credits (ODOE)

Tax credits can reduce the amount of taxes owed. Periodically, state and/or federal tax credits may apply to cleaner-burning appliances. Tax credits, deductions, and rebates can be very effective (for example, as they are with Energy Star appliances) to steer consumers to the cleanest and most efficient products. In past years, federal tax legislation has provided 10-30 percent tax credits for purchase and installation expenses of up to $1,500 for cleaner wood and pellet stoves. In Oregon, a residential energy tax credit is offered for the highest energy efficient wood and pellet stoves that meet specific criteria. The tax credit amount is based on the estimated average first year energy savings and cost for equipment. For wood and pellet stoves that qualified, the tax credit amount was 25 percent of the net cost up to $300. The program has been in effect since 2009 although the amount of tax credit has varied from year to year based on changes to administrative rules. To date, over 22,000 residents have utilized the tax credit[29]. The tax credit program will sunset at the end of 2017.

In other states, such as Montana – it offered an Alternative Energy Systems Credit ($500) against income tax liability for the cost of purchasing and installing an energy system in a principal home that uses " . . . a low emission wood or biomass combustion device such as a pellet or wood stove." Idaho offered taxpayers who bought new wood stoves, pellet stoves, or natural gas or propane heating units for their residences a tax deduction (up to $5,000) to replace old, uncertified wood stoves.

7.17 Providing alternate heating devices for low-income residents

For many years, Lane Electric's Heat Pump program has offered $1,000 rebates or zero interest loans (up to $9000) for the installation of ductless heat pumps in Oakridge. Low-income residents were eligible to receive a free ductless heat pump and rental property owners of low-income occupied homes could receive up to 50% off the cost. In an effort to address the PM2.5 nonattainment problem Lane Electric will offer new heat pumps free of charge (up to $3800) to all homeowners and rental property owners of low-income occupied Oakridge housing until December 31, 2015. So far, 30 ductless heat pumps have been installed in 2015.

8. Biomass fuel & use in Oregon

8.1 Background

The types of biomass most commonly used for heating energy include waste wood from the timber and wood products industries, as well as agricultural residues. These fuels can either be directly combusted, or they can undergo a variety of refining processes such as chipping or pelletization for use in a variety of applications. Woody biomass in the form of cordwood is the most common residential wood fuel. There are many reasons people use biomass products, including demand for energy independence, an interest in using renewable resources, and an interest in carbon neutral fuels.

[29] Based on 2010-2015 numbers. 7,025 residents applied for a tax credit for the purchase of a pellet stove or woodstove, and 15,033 residents applied for a tax credit for the purchase of a ductless heat pump.

8.2 Cordwood (Firewood)

Firewood is the original renewable fuel and still being used as the sole source of heat for approximately 1.5 million homes in the U.S. While most homes burn firewood or cordwood, it is not always burned efficiently. Properly seasoned (dry) cord wood can have a moisture content ranging between 15%-20%. It is important to note that not all cordwood is properly dried before use and "green" firewood emits more harmful smoke. Some of the challenges with cordwood, particularly if the homeowner cuts it himself, include ensuring it is procured and chopped early enough in the season to allow at least 6-12 months for it to dry out, ensuring it is stored properly and kept dry, and cutting uniform pieces of wood to enable an even burn. In Oregon, wood is abundant and is an inexpensive way for people to heat their homes, particularly if you go out and cut, transport, and stack the wood yourself. To purchase cut, dried, and delivered cordwood, costs are roughly $200/cord of wood (although there are both less expensive and more expensive options, depending upon the species and quality of the wood).

8.3 Pellet fuel and other types of biofuels

8.3.1 Pellet fuels

Pellet fuels are typically made from compressed organic matter, and can be derived from energy crops, virgin lumber, industrial waste and co-products, food waste, and agricultural residues. There are many different types of pellet fuels, including wood pellets, which are the most commonly used for residential heating, but also corn, grass, and mixed pellets, as well as biobricks or compressed logs. Clean mill residuals such as wood shavings, sawdust, and wood chips comprise the main feedstocks for wood pellets in Oregon. One pellet mill uses small-diameter roundwood as feedstock for residential pellet production.

According to the U.S. Environmental Protection Agency, pellets are the cleanest solid fuel and operate efficiently at 70 to 83 percent, contributing very little to air pollution. Pellet fuel is a renewable, clean-burning, and cost-effective alternative currently used throughout approximately 1,000,000 homes and businesses in the United States[30].

The Pellet Fuels Institute recognizes three grades of pellet fuel: utility, standard, and premium. Some producers also offer "super-premium" grade pellets. Grades are set on bulk density, size, durability, ash content, heating value and other characteristics. Industrial pellets destined for exports adhere to the standards of the importing country.[31]

8.3.2 Wood pellets

Wood pellets are the most common type of pellet fuel for pellet stoves and are generally made from compacted sawdust and related industrial wastes from the milling of lumber, manufacture of wood products and furniture.[32] Pellet manufacturers resize, dry, compress, and form it into small, uniform cylinder-shaped pieces (generally measure between 0.25 inches to 1.5 inches in length) for burning in pellet stoves.

These pellets are clean and produce virtually no smoke when burned. Pellets are sold nationwide in 20- to 40-pound bags. An average home owner uses 1 to 3 tons of pellets at a cost of roughly $250- $750 per season[33]. Most of the pellets sold for residential use (there are also pellets manufactured for industrial and commercial use) are of a high quality fuel, but there is no certification or standardization to ensure pellets sold on the market meet minimum requirements of moisture, ash, or heat output content. An independent organization, the Pellet Fuels Institute (PFI) is the only program in the United States that employs a voluntary certification program to ensure high quality pellet fuel and most of the major pellet brands could pass PFI standards. Currently there are fifteen qualified production facilities that meet their voluntary certification standards.

[30] http://www.pelletheat.org/benefits-of-pellets
[31] http://www.pelletheat.org/joining-the-standards-program
[32] https://en.wikipedia.org/wiki/Pellet_fuel
[33] U.S. Department of Energy, http://energy.gov/energysaver/wood-and-pellet-heating

Wood pellets have a BTU output content of 350,000 per cubic foot of fuel, versus 70,000 to 90,000 for cordwood or wood chips. This means pellets produce more heat. Wood pellets are an efficient source of heat for wood burning devices because they contain very low levels of moisture and ash, and are denser when compared to woodchips or cordwood. Virtually all of the material is burned and converted to heat due to its high combustion efficiencies. Dry cord wood has a moisture content (MC) of approximately 20%. Wood pellets are dried to 6-8% MC. Since wood pellets are typically produced from recycled sawdust, it is a way to divert timber by-products and other waste materials from landfills and turn it into energy.

Like regular firewood, wood pellets do not burn well when wet. Wood pellets should be kept off the ground and stored in a dry location. No dust or dirt is brought into the home with pellet fuel and it is stored in less space than what is needed for firewood. Four times more pellet fuel can be stored in a given space than cordwood or wood chips. A winter's supply of pellets for an average home occupies a space roughly 6' x 6' x 6', where it can be stored in a small area of a dry garage, basement, utility room or shed.

Burning pellets in a properly designed, installed, and maintained pellet stove will greatly reduce emissions, as compared to those of a woodstove (especially a non-certified, older generation woodstove that burns poor quality (high moisture) cordwood. Due to the refined nature of the fuel and the efficient design of the stove, there is virtually no creosote formation in the exhaust venting. Thus, traditional "chimney fires" are non-existent. Bags of pellets pour directly into a stove hopper regulating the rate at which the fuel flows into the hopper. A precisely regulated fuel feed automatically operates the stove according to owner-determined settings. Because of this "mechanization", it eliminates some of the operator error inherent in operating a traditional woodstove.

A broad range of pellet stoves, central heating furnaces, and other heating appliances have been developed and marketed since the mid-1980s. Nowadays, pellet stoves cost between $1,000 and $4,000, including between $500 and $1,000 for installation. Based on lab studies, no matter how clean the woodstove is, it can be abused by the homeowner with great variation. Compared to real world testing of pellet stoves, the fuel is consistent and the consumer cannot deliver too little air to it because the air supply is regulated. Unlike woodstoves, pellet stoves work on software and are easy to change if needed.

With the surge in the price of fossil fuels since 2005, the demand for pellet heating has increased in Europe and North America, and a sizable industry is emerging. Wood pellet popularity has increased in the UK and been widely used in Europe for a number of years. Sweden, Germany and Austria in particular have traditionally been big users of wood pellets as fuel. European national governments are aggressively incentivizing wood heat in addition to regulating it. Incentives in Europe have also helped to move consumers from wood to pellets, a policy tool that has yet to be used in the US except very locally, in changeout programs.

8.3.3 Compressed wood fuel (bio bricks, wood bricks, bio logs, fire logs)

One of the next most popular forms of biomass fuel is compressed wood fuel. Marketed as an alternative to cordwood, these are 2" x 4" x 6" bricks or logs made of compressed sawdust, similar to wood pellets. Compressed wood fuel is typically manufactured in the same facility as a pellet fuel factory, as it uses the same materials; only the shape and size are different. The bricks or logs are stackable, burn clean with less than 1% ash[34]. Compressed wood fuel relative to its weight emits less pollution than the same weight of firewood. Compressed wood fuel has 8-10% moisture content. Because compressed wood fuel burns hotter than cordwood caution must be taken to not overload the stove, otherwise it could cause performance issues, such as causing the stove to reach unsafe temperatures in the stove and chimney. In the older stoves it could cause warping of stove parts. Biobricks vary considerably with regards to its content (type of wood used, whether there are fillers) because there is no standard or guideline that currently exists. This variability can affect its emissions performance in woodstoves.

[34] Chris Sharron, West Oregon Wood Products, conversation November 2015.

However, according to the EPA, data show that burning one manufactured biobrick in a fireplace emitted less air pollution than burning several pieces of wood in the same fireplace.[35] Additional studies indicate biobricks could be a lower emitting fuel compared to cordwood.

Biobricks or logs are comparable in costs to wood pellets, at roughly $250 for one ton of product. For comparison purposes a cord of wood costs under $200. A challenge with biobricks is that, like cordwood, it needs to be kept dry. Typically, biobricks or logs are shrink-wrapped on pallets to prevent moisture from seeping in and for ease of shipping. However, to unload and store the biobricks the shrink wrap must be removed and the biobricks should be placed inside to avoid them taking on additional moisture that could affect the performance of the fuel.

8.3.4 Corn pellets

A new type of fuel for pellet stoves is in the form of corn pellets. Similar to wood pellets, 40-pound bags of corn pellets can be purchased for residential use. One disadvantage to using corn pellets for home heating is that it requires a pellet stove that is designed specifically for corn, of which there are few stoves available on the market. Corn pellets cannot be used in traditional wood pellet stoves, as they produce excessive ash that traditional pellet stoves cannot handle.

8.3.5 Grass and other mixed materials pellets

Development of other pellet fuel using grass, nut shells, seeds, and other materials is underway. There are a few advantages to grass pellets or bricks over wood pellets in that grass can be grown quickly and easily and often in large volume. Grass can be formed into large bricks, providing a less expensive densification method through allowing the grasses to dry in the field, reducing the drying costs at a pellet mill.[36] However, grass fuel has a much higher ash content and burning variability, and there are very few stoves available that can burn this type of fuel. For those few stoves that can burn grass pellets, they typically cannot burn any grass pellet with more than 5% ash content. The lower ash content in grass pellets may actually increase the chances of problems due to chunks of melted ash ("clinkers"), because low ash grass tends to have ash with a lower melting point.[37]

9. Market availability and production in Oregon

Oregon has a robust and mature wood pellet and biobrick manufacturing base with 11 facilities producing 520,000 tons of wood pellets, bricks, and firelogs. This production consumed 700,000 tons of sawdust and other clean wood residuals annually.[38] All but one of Oregon's wood pellet producers use sawdust and clean residuals as feedstock for production. The Ochoco Lumber Co. facility in John Day uses a combination of mill residues and trees with a small trunk diameter. Table 5 identifies the wood pellet manufacturers in Oregon.

[35] http://www.epa.gov/burnwise/faqconsumer.html#aremanufacturedfirelogs.
[36] Biomass Energy Research Center, "Grass Energy – The basics of production, processing, and combustion of grasses for energy", 2009, http://www.biomasscenter.org/images/stories/grassenergy_factsheet.pdf
[37] College of Agriculture and Life Sciences, Cornell University, "Frequently Asked Questions", December 2015, http://forages.org/index.php/faq-gb
[38] The 2012 Forest Report, Oregon Forest Resources Institute

Table 5: Biomass (Wood Pellet and/or BioBrick) Manufacturers in Oregon

Company	Location (OR)	Capacity (Tons)
Bear Mountain Forest Products	Cascade Locks Brownsville	40,000 125,000
Blue Mountain Lumber Products	Pendleton	20,000
Frank Lumber Company	Lyons	21,000
Pacific Ag	Boardman	30,000
Pacific Pellet	Redmond	40,000
Ochoco Lumber	John Day	22,000
West Oregon Wood Products	Banks Columbia City	50,000 30,000
Roseburg (currently idle)	Dillard	40,000
Nature's by Woodgrain Millwork (since closed)	Prineville	30,000

9.1 Wood pellet market

There is an opportunity for densified biomass fuels (pellets and firelogs) to gain market share in Oregon, especially in the outlying, rural areas. Oregon has available raw materials that could be harvested from the local forests. This "thinning" of biomass could improve forest health by propagating growth, warding off disease and insect infestation, and thinning forest understory to mitigate catastrophic wildfires.

DEQ spoke with three pellet fuel manufacturers who sell their wood pellets primarily for residential use (75%-95%). The remainder of their pellet sales goes towards commercial use such as for pellet boilers to heat schools, hospitals, ranger stations, or to be used as cat litter. Manufacturers would like to see pellet fuel used to generate hot water or steam that could be used year round.

9.1.2 Wood pellet consumer purchasing habits

General purchasing habits can vary depending upon storage capabilities, need, and ability to buy in bulk. Pellet fuel can be found in many retailer and hardware stores where homeowners can buy one bag at a time (for example 1 bag a week) or purchase in bulk (1 ton - 50, 40 lb bags) for the season. Because pellet fuel is readily available, homeowners can purchase at any time as the need arises, as opposed to firewood when wood needs to be cut, stacked, and seasoned at least 6 months prior to use. As time goes on, people are getting it when they need it and wait until the season.

In some areas of the country, pellet fuel is delivered to homes. This is typically concentrated on the East Coast where homes are equipped with pellet bulk bins and homes receiving delivery are located within blocks of each other. The challenge in Oregon is that there are not enough residents with bulk bins in their homes, particularly in rural areas where pellet customers can be 30 miles apart. Bulk pellet delivery is available statewide but costs vary depending on transportation distances.

9.1.3 Difficulties expanding marketplace

While manufacturers would like to expand production, they can't get enough market demand. Additionally, the cost of shipping to the East Coast or overseas adds to their costs. Manufacturers reported selling less pellets today than they did 10 years ago. Some of the challenges to expanding the marketplace include:

- Competing with Natural Gas. The biggest challenge is competing with natural gas, which is the cheapest fuel to burn. The West has a very good natural gas infrastructure, except for rural areas that don't have natural gas piped in. Wood pellet manufacturers compete well with electricity, oil and propane, but not natural gas.

- Access to Raw Materials. In manufacturing biomass products, proximity to raw materials is important. Often there is a lot of biomass (such as small diameter trees and debris) that can be used, but it is economically not feasible due to transportation costs to get the material out of the forest and to the market. Therefore, most biomass manufacturers rely on sawmill residuals for their wood. Unfortunately, it is cheaper to burn the forest residuals in slash piles than to convert it to biomass products.

- Investing in a New Heating Device. The incentive for people to buy a residential or commercial unit and retrofit their heating device to pellets is driven by economics or personal finances. Even if pellets were cheaper to burn than other options, the residential customer has to invest $3,000-$4,000 in a pellet stove. The return on the investment takes many years. A $3,000 investment in a pellet stove is often the hurdle – especially in a milder climate like Oregon, where heat requirements (no matter the source) are not that significant compared to many other areas of the U.S. Thus a reasonable return on investment could be a challenge for many.

- Milder Climate in West Coast. The Northeastern states have a stronger market for pellet fuel in part because of colder, longer winters. New England states use 8-10 tons a season versus 2 tons in Oregon. New England doesn't have natural gas, and most heating is done by oil. With bigger, older homes in colder New England that are not well insulated, the return on investment could be two years, whereas the return on investment is not as strong with a milder climate and the abundance of natural gas that we have here.

9.2 Compressed wood fuel - biobricks & logs market

A few manufacturers in the West produce compressed wood fuel (wood fire logs, wood bricks, bio bricks). Bear Mountain Forest Products manufactures bio bricks at their Cascade Locks facility, Ochoco Lumber produces a bio brick at their John Day facility, and West Oregon Wood manufactures bio-logs at their Columbia City plant. An integrated juniper utilization facility in development for Klamath County aims to produce compressed juniper fire logs. Current production of wood bricks is estimated at less than 15,000 tons a year combined[39].

9.3 Wood pellet industry growth

Capital construction estimates for new wood brick or pellet facility run approximately $1 million dollars per ton per hour of production. A new turnkey facility capable of producing 12,000 finished tons per year would cost approximately $5 million dollars. If demand for wood bricks or fire logs exceeded supply several options would be available:

- Add additional shifts at existing facilities
- Add additional equipment to boost capacity at existing facilities
- Add new brick making capacity to existing wood products facility with manufacturing capability and required equipment e.g. rolling stock, covered manufacturing space, etc.
- Build new facility from the ground up. This option would be the most expensive and likely cost prohibitive.

[39] Discussion with Marcus Kauffman, Oregon Department of Forestry, October 2015

9.4 Wood waste options

Metro is exploring options for utilizing wood waste. Because urban wood waste comes from a large variety of sources, it contains a large variety of contaminants. Most of the urban wood waste in the Portland metro area, for example, is from construction and demolition activities. According to Metro, nearly 248,000 tons of urban wood waste was generated in 2009.

One option Metro is exploring is the feasibility of transferring wood waste into biomass materials such as pellet fuel. In order to migrate this material into pellet operations, the material would need to be sorted by species as well as be clean from contaminants. There is European technology that has systems to convert urban wood waste into raw material suitable for densified wood fuels. Further examination is needed to determine the cost of producing this raw material into something the wood products industry could use. Because of the cost and complexity of the technology, a single central facility would need to be constructed to process urban wood waste. Such a facility would cost around $5 million to establish.

10. Subsidies for residential pellet use

Currently there are no state-wide subsidies or rebates available for residential pellet fuel, although there are many incentives for industrial pellet use. Most of these efforts focus on partnerships between power plants, public buildings, and biomass producers. The incentives that are available on a residential level are primarily in the form of rebates and low-interest loans for purchasing pellet fueled devices.

10.1 Tax credits/incentives

In 2009, the Oregon Department of Energy provided a $10 tax credit to homeowners who purchased one ton of pellet fuel. The tax credit has since ended.

10.2 Feasibility, costs & challenges

Incentivizing pellet fuel may help encourage more biomass use than through pellet stove rebates alone. It also can be tailored to fit the needs of the pellet stove user more appropriately, in that light to moderate users of pellet stoves would only get a little compensation since they purchase a small amount of pellets, whereas heavy pellet stove users would receive larger incentives. As mentioned earlier, a ton of pellets is usually around $300 and offering a subsidy of 20% might be enough to persuade homeowners to utilize a rebate, particularly if a house uses on average two tons per season. Ensuring the incentive would last for a number of years may help get homeowners to switch.

Managing a program where rebates are provided to consumers through their submitted receipts could be costly and time consuming from an administrative standpoint. One option would be to provide rebates only for bulk purchases of one ton, but this may exclude lower income homeowners who buy pellet bags individually because they cannot afford to buy or store such a large purchase.

Another challenge in subsidizing pellet fuel is that there is no standardized pellet quality. Currently none of the Oregon pellet producers are PFI certified, although there is one in Idaho. No federal or state agency requires certification of fuel in order for it to be sold, and for manufacturers, the certification process can be timely and costly with little apparent benefit.

Appendix A

Summary of Workgroup Discussion – Woodsmoke Reduction Strategies

The following is a summary of the workgroup discussions regarding each strategy identified to reduce woodsmoke. It provides the basis for and helped inform DEQ in developing its recommendations to the Legislature. To address wood smoke in communities, the workgroup and DEQ evaluated current programs and identified new strategies and funding options to build upon current progress DEQ and local communities have made.

The workgroup also discussed the realities of how communities are trying to tackle the problem and what will and will not work. This includes an acknowledgment of a strong culture of woodstove use, lack of staffing to implement programs, easily accessible wood supply, and economic barriers to struggling communities. Recognizing these challenges, plus the issue of many communities across the state that are either violating or are in danger of violating fine particulate standards ($PM_{2.5}$), the workgroup acknowledged a need to immediately address these areas to bring PM2.5 levels down. The workgroup discussed many different strategies and how they would be implemented; these are discussed below:

Strategy: Local community funding to implement woodsmoke reduction programs
The workgroup recommended funding amounts be provided via the Legislature and discussed what it would take to fully fund programs in each community, estimating it would be $500,000 per year, or $1M per biennium. The workgroup discussed how locally implemented woodsmoke reduction programs (such as woodstove curtailment, education/outreach, and open burning restrictions) have been the most effective way to reduce woodsmoke in communities. These programs have been funded in partnership between the local government and DEQ. However ongoing cuts over the years in both local and DEQ funding have now made implementation a challenge. For these programs to continue increased funding would allow the local governments and agencies to continue to operate and enhance woodsmoke reduction programs in their communities and it would provide local resources to really engage with the public through community outreach and oversight, particularly to fund dedicated local staff year-round within each community. If funded, the local air quality coordinator would be able to:

- Provide woodstove advisories on poor air quality days, enhancing their social media, educational outreach (door hangers, billboards, radio, and newspaper ads) to residents of when not to burn.
- Conduct compliance monitoring, outreach and education, technical assistance, and enforcement if needed. This includes day and nighttime surveys of households to determine if residents are burning during no-burn days, following up with letters or in-person visits. Ability to investigate complaints if there is excessive smoke coming from chimneys during the winter heating season.
- Conduct year-round public education & assistance (as opposed to just focused during the winter wood heating season) –participation in local events, air quality presentations to schools and community meetings. Partner and work with teachers in the schools to integrate a woodsmoke education component in the classroom.
- Coordinate with state and local partners to increase home weatherization.
- Write and pursue grants and leverage local partnerships to supplement woodsmoke reduction programs, such as woodstove changeouts, free or reduced-cost firewood program, woodstove bounty program.
- Institute or expand a school flag program (working with the local schools to display red, yellow or green flags during the winter wood heating season to indicate wood burning advisory status for the day).
- Distribute bilingual educational materials and work with at-risk and minority communities.

- Coordinate with DEQ and state and federal forest management agencies on smoke management issues.
- Provide tarps to residents with uncovered wood piles, moisture meters to test wood

The workgroup recommended DEQ allocate funding to communities based on a set of criteria developed by DEQ. DEQ would have the flexibility to fully fund each local program, however, the workgroup also recommended each local government provide some level of local match funding (whether in-kind resources or dollar amount) in order to reinforce the local governments' commitment and responsibility to the air program and health of their community. Workgroup members indicated that knowing there is consistent and sustained funding to help with their work better helps communities budget and solicit grants more easily.

Strategy: Immediate funding to address urgent community needs (e.g. serious nonattainment areas) in Oakridge

The workgroup also recommended a one-time funding request of $1M for Oakridge, a community designated nonattainment and has not met the federal deadlines by which the area needs to come back into compliance. Oakridge has not met the federal deadline by which the area needs to come back into compliance and is in danger of becoming the first and only area in Oregon history to be designated "serious" nonattainment. A serious nonattainment designation means the area will be required to enact additional and more stringent requirements on woodstove use and hinders options for industrial development, creating economic challenges in a town where 56% of the households qualify as low-income. The workgroup discussed how Oakridge has developed a plan that will immediately address the nonattainment but it would take another $1M to do so.

Providing $1M will immediately address the nonattainment problem through funding a strategy plan developed by local community partners in Oakridge. The plan includes funding for:

- Hiring a full time coordinator to implement local programs such as woodstove curtailment, outreach and education, and coordinate between partner agencies and organizations;
- Staffing a full time code enforcement officer to enforce no-burning and proper burning ordinances;
- Funding a program to replace 82 woodstoves that currently receive burning exemptions (due to low-income or sole source of heat), with free ductless heat pumps and home weatherization;
- Replacing uncertified woodstoves in the rest of the community, including renter occupied homes;
- Developing educational materials and videos;
- Offering compensation on electric bills during no-woodburning days, when residents must use electric heat.

The immediate funding for this plan will bring the area back into compliance with the standard and ensure Oakridge is on a path of continued compliance.

Strategy: Fund a woodstove changeout program in a targeted community - $10M for 2017-2019 biennium

The workgroup recommended conducting and providing $10M in funding for a two-year, woodstove changeout program in various communities. The workgroup discussed the sheer cost of replacing every single woodstove in the state, which would run about $450M (at a cost of $3,000 per replacement). Recognizing it would not be financially possible nor practical to replace every single uncertified stove in the state the workgroup determined $10M would provide funding for targeted communities to help address woodsmoke and replace old stoves. Changeouts alone will not address the woodsmoke problem, but when combined with local community program efforts it becomes an effective tool to lower PM2.5 levels.

DEQ and the workgroup identified how the changeout program could work. For example, interested communities would need to apply and present a proposal of how it would implement the program. Each community would include in its funding proposal application:

1) An explanation of why their community should be eligible. (e.g., nonattainment area, close to violating the standards and high population affected)
2) Its approach to conducting the woodstove changeout program, including program components such as, eligibility, changeout device options, how funding will be made available to residents, and other implementation and management aspects of the program.
    - For example, this could include hiring a full time-coordinator to implement the program. The program coordinator could do the following: solicit public participation and assist residents in filling out paperwork and determining eligibility for all changeout and weatherization funds available, education and outreach to residents receiving new heating devices on proper burning practices, information on how to use moisture meters, and check-in visits with residents who may require additional follow-up regarding proper operation of their new heating device.
3) If applicable, identification of other on-going or planned programs to help reduce woodsmoke. As an example, the workgroup identified the following as additional programs that could supplement a changeout effort:
    - Education and outreach
    - Conducting a community survey to assess device and heating use to better target changeout participants.
    - Offering a bounty program for anyone turning in an old uncertified stove
    - Exploring options for the use of cleaner, biomass-based heating fuels.
    - Weatherization dollars that can be accessed to improve viability of change outs
    - Local wood banks or firewood exchanges
    - Bounty program for people to turn in their old uncertified stove for a voucher
4) A commitment of resources (such as staff time) or matching dollars. This can include who they are partnering with or already existing partnerships with regards to funding or in-kind contributions. Additional matching funds could be obtained through grants and loans from a mix of public, private, and philanthropic partners.
5) A demonstration of how the community will measure air quality improvements, such as baseline data and metrics that can be measured.

To assess the success of the program, the workgroup recommended that at the end of the each changeout program, a report be provided to the Legislature regarding the program's effectiveness and lessons learned. The goal would be to document air quality improvement, reduced risk to public health and nonattainment in the community. The workgroup also strongly urged incorporating home weatherization as a critical component in ensuring home heating device change outs are successful.

The workgroup considered a number of different funding options, including general funds, bonding, and assessing fees on woodstove sales or wood cutting permits. After discussing which options would best provide a reliable, consistent source of funding for changeouts near-term and in the future, the workgroup recommended funding be pursued via a tax credit auction. A woodsmoke tax credit would be created and these credits would be auctioned off to fund grants for woodsmoke reduction projects. This would be modeled after the Renewable Energy Development Fund (Oregon Revised Statute 315), in which Oregon taxpayers can purchase tax credit certificates in increments at a minimum discount of 95 percent of the face value of the credit (e.g., $950 for a $1,000 tax credit). If funding through a tax credit auction is not pursued, the workgroup recommended a request of $10M in general fund to cover the costs of the changeout program. However, while a changeout in one community might replace all or almost all the uncertified stoves, in larger communities it will require continued funding. Therefore, the workgroup recommended the Legislature provide an option for continued funding. This could include a commitment by the Legislature to fund a changeout program for the next 10 years.

Strategy: Increase woodsmoke awareness and education efforts across the state

The workgroup recommended developing tools and providing resources for the state and communities to increase education, outreach, and awareness of woodsmoke's health effects. The workgroup discussed how critical education and outreach are to any successful woodsmoke reduction program. Ensuring the public is aware of how woodsmoke can affect their health, their neighbor's health, and the economic well-being of the community has a direct impact on the local community's ability to implement reduction programs. If residents do not understand why these programs are important, they are not as effective.

Additional efforts to inform residents about the health effects of woodsmoke could include creating educational videos in multiple languages to reach potentially underserved communities, expanding a community's social media presence with informational tweets and posts about woodburning, providing year-round education through informational billboards, radio spots, newspapers, and television ads, and developing outreach materials that can be easily tailored for each specific community. Other tools for communities could include developing a statewide reference manual with education and outreach information, templates for educational brochures and handouts, and implementation guidance on how to run curtailment programs for local communities to utilize and adapt for their area. It could also include information on woodstove changeout programs (local and national), and available funding sources. This manual could be updated on a yearly basis.

Strategy: State directive for multiple state agencies to target air quality areas of concern

The workgroup recommended a state or legislative directive for specific state agencies to collaborate, and focus efforts on air quality areas of concern. Additional coordination allows agencies that address woodstove changeouts, home weatherization and energy assistance help local communities. This could be through efforts to potentially combine assistance, identify funding, and prioritize staff resources. Specifically, the workgroup discussed how a directive of this nature would provide agencies, such as Housing and Community Services, the ability to request and potentially direct federal weatherization and changeout funds to air quality areas of concern.

Strategy: Conduct a biobrick study to study emissions & safety performance in woodstoves as a potential option for household use, particularly during poor air quality days

The workgroup recommended the Legislature provide funding to conduct the study of biobricks and kiln-dried firewood to ascertain whether this type of biomass fuel is an option for communities and could be eligible for homeowner subsidies. The workgroup had many discussions about biobricks and how it could be a lower-cost, lower-emission option for households needing to heat their home, particularly during poor air quality days when use of wood burning devices may be banned. However, to ensure this is a clean and safe option for residents in at-risk communities, DEQ and the workgroup determined additional research is needed to fully understand the emissions and safety characteristics of burning biobricks in wood burning stoves.

Additionally, the workgroup recommended kiln-dried firewood could be used as another source of clean, dry, fuel for communities. Because it is another potential source of fuel that has not widely been utilized due to limited availability, the workgroup recommended conducting an evaluation of the economic costs to manufacture, purchase, store, and utilize kiln-dried firewood on a larger scale in communities throughout the state.
The study would include testing for:

- Emissions performance in certified and uncertified woodstoves (including catalytic, noncatalytic, DEQ certified, current 2016-EPA certified stoves), how it compares to cordwood and pellet wood emissions under real-world use conditions.
- Safety and chimney temperature testing in certified and uncertified stoves, to ensure there are no potential fire hazards with using these products.
- Testing of multiple bricks at a time, including the long term effects of prolonged burning and if it adversely affects the performance of the stove.
- Testing of multiple fuels such as burning both biobricks and cordwood concurrently and comparing the emissions performance to just cordwood only.
- Economic analysis of the costs to manufacture and sell kiln-dried firewood, and whether it can be another low-cost option for communities.

- Feasibility study on how kiln-dried firewood and biobricks are stored and used by households.

The workgroup discussed how funding for the study could be acquired through a partnership with a university to get a grant to conduct the work (e.g. Oregon State University) or through a partnership with other interested states such as Washington and Alaska to conduct the study.

Strategy: Renew the tax credit to incentivize cleaner burning efficient heating devices
The workgroup recommended the tax credit to incentivize cleaner burning efficient heating devices be renewed. The workgroup also recommended the tax credit provision be modified to offer the incentive towards the purchase of clean burning efficient woodstoves only if it is replacing an uncertified stove and to allow a tax credit for the purchase of any pellet stove or ductless heat pump. This will provide an additional incentive for homeowners looking to replace their old, uncertified stove.

Currently, the Oregon Department of Energy offers a tax credit to Oregon residents for the purchase of a new, highest energy efficient, clean burning woodstove, pellet stove, or ductless heat pump. The program has been in effect since 2009 although the amount of tax credit has varied from year to year based on changes to administrative rules. The tax credit program will sunset at the end of 2017 unless the program is renewed.

Additional strategy approaches to address public health; potential state measures and options for local communities
The workgroup discussed the public health effects of woodsmoke and some members felt DEQ needed to take a stronger, health-based approach to address woodsmoke in communities. The workgroup discussed a list of concepts, many of which were suggested through public comment as potential actions. The workgroup understood the desire to recommend more stringent measures to address woodsmoke and discussed ways to address this concern. Recognizing there are different needs for different communities, the workgroup sought to strike a balance between densely populated areas where woodsmoke can have a larger public health impact versus other communities that are concerned about woodsmoke but also struggle with other societal and economic needs.

Because there is no one-size fits all approach for the diverse communities in Oregon, the workgroup decided to recommend a suite of options for communities wishing to implement additional measures to address woodsmoke. The majority of workgroup members decided these measures may be more effective on a local level where enforcement and implementation is more feasible than on a statewide basis. The workgroup also identified some concepts provided through public comment that would not be feasible to move forward. The list includes:

Potential state-wide implemented strategies:

- Add residential wood burning appliance disclosures regarding the PM2.5 health hazards of woodsmoke to real estate and rental agreements
- Ban open hearth wood fireplaces in new construction homes
- Require health impact labeling of firewood sold in commercial establishments (e.g. grocery stores)
- Require removal of uncertified wood burning device at the time of any major home remodel (15% of the home's value)
- Require chimney height regulations
- Create a statewide census to audit sole source of heat exemptions

Potential locally implemented strategies (these were recommended as options for local cities and metropolitan areas that wanted to take further action to address woodsmoke)

- Establish regulations for home and commercial woodstoves, and the amount of smoke they emit (opacity requirements – 40%).

    - Add a provision if a neighbor complains about woodsmoke, it could be subject to enforcement action.
- Requiring registration (and fee) for wood-burning devices
- Require periodic maintenance and inspection of wood-burning devices by a qualified hearth industry specialist and submittal of the maintenance/inspection report to City/County Building/Planning Department, if the residence has a permit to burn on a red air quality day,
- Require education on the health effects of wood burning for any commercial or restaurant establishment that is putting in a wood fire appliance or is permitted through the building codes to have one installed.
- Require any homeowner (including landlords) with an uncertified device to upgrade by a set date (e.g., two years to comply) and any homeowner who fails to do so is subject to penalties for continued use of an uncertified stove

Strategies that were discussed but not recommended for any further action on a state or local level at this time.

- Declare a moratorium on commercial or restaurant wood burning for new establishments; Establish regulations for all wood-fired restaurants and BBQ eateries;
- Restrict or ban the use of backyard fireplaces and firepits
- Require reduced campfire use at state parks, do not allow summer burning of campfires

Supplemental woodsmoke reduction projects that can be implemented on a local or statewide level

The following is a list of additional recommendations identified by the workgroup as strategies that can be implemented– if funding is available and can be matched by other funds (through private, philanthropic, or federal funds). These supplemental projects could include, but are not limited to:

- Local wood banks / Community firewood program ($5,000 - $10,000/community/year, up to 8 communities): Provide funding or resources to establish wood banks or firewood giveaways in local communities. Communities could provide free firewood or subsidize dried firewood for low-income residents or seniors to purchase and use. These programs provide a great educational opportunity within the community to have a one-on-one conversation about burning properly and reaching out to at-risk populations.
- Create a statewide or local bounty program ($10,000/year): Provide a bounty of $100-$150 per uncertified stove turned in. DEQ could provide pass through funds to local communities to administer the bounty program.
- Create a reimbursement program or fund to provide low income people relief on heating bills to waive costs on red days. ($100,000): During poor air quality days many communities ban the use of wood burning devices which requires residents to utilize alternative heating fuels in homes (heat pumps, high efficient natural gas devices, oil, or other heating devices other than wood). (Note: there may be some logistical challenges with this approach)

Strategy: Exploring the expansion of natural gas to communities that do not have access

One of the challenges for some communities trying to address wood smoke issues is the lack of natural gas availability as an alternate source of heat. The workgroup recognized the efforts underway as a part of Senate Bill 32 and encourages the appropriate agencies and stakeholders to continue researching this issue.