

CASE STUDY: PUGET SOUND CLEAN AIR AGENCY'S RESIDENTIAL WOOD SMOKE REDUCTION INITIATIVE

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September 13, 2013

BACKGROUND

Household wood combustion is a major contributor to ambient fine particle levels in the United States. Roughly one-half to two-thirds of the residential wood combustion in the United States occurs in wood stoves as opposed to fireplaces. In 2009, the EPA classified parts of Pierce County, Washington as a “nonattainment area” due to unhealthy levels of fine particle pollution (PM_{2.5}) during the three year period from 2006-2008. During certain times of the fall and winter, the Tacoma-Pierce County nonattainment area does not meet the federal health standard for the maximum level of fine particle pollution allowed in a 24-hour period. During times of impaired air quality, the Puget Sound Clean Air Agency (PSCAA) issues county-wide burn bans. A burn ban is a mandatory, yet temporary, order that restricts the use of wood stoves and fireplaces. This case study is an analysis of program alternatives that the PSCAA and other air quality regulatory agencies can use to reduce wood smoke particulate emissions without increasing the cost burden on low-income and low-wage earning households during burn ban days.

PROGRAM OBJECTIVES

The objective of a burn ban financial assistance program is to provide support to low-income households that do not have the financial means to comply with the burn ban either because they cannot afford an alternative source of heat or their alternative source of heat is not working as designed. In addition, some households that do comply with the burn ban are economically disadvantaged and either live without heat on the burn ban days or are forced to reduce expenditures on other primary needs such as food. The potential burn ban financial assistance programs assessed in this evaluation are short-term (two to three year) programs designed to assist the economically disadvantaged. They are designed to be used in partnership with federal and state weatherization programs and utility-backed bill assistance programs. In this way, a portfolio of solutions is available to help households on burn ban days as well as facilitate their compliance with the upcoming deadline that mandates removal of all uncertified wood stoves in the Tacoma-Pierce County nonattainment area by September 2015.

There are a number of alternatives that agencies could consider to incentivize households in nonattainment areas to discontinue use of wood-burning devices on burn ban days. These options include direct subsidies to households, utility supplied incentives and rebates, weatherization programs, wood stove replacement programs and need-based assistance programs. The alternatives for PSCAA were considered based on the following key criteria:

1. The program must have the ability to assist the economically disadvantaged.
2. The program must be able to be implemented during the 2013-2014 heating season.

3. The program must have short term emission reduction benefits, but ultimately must lead to long term changes in behavior and permanent reductions in fine particulates.

Based on these objectives, two programs were selected for further evaluation in the Tacoma-Pierce County nonattainment area:

Burn Ban Assistance Utility On-Bill Credit Program

A potential solution to reduce fine particulate matter during burn ban days is to incentivize the area's 13,792 low-income households that use a wood-burning device to instead use an alternative heating source (electricity, natural gas) during burn ban days. One way to accomplish this is to implement an on-bill utility credit program in coordination with local utility companies. In an on-bill credit scenario, a household would apply for an annual subsidy and if approved (based on income and proof of wood-burning device), would receive a credit on their utility bill equal to the estimated cost of using the alternative heating source on the burn ban days.

Wood Stove Replacement Program for Low-Wage Earning Households

This program model was elected for analysis because it addresses the long-term challenge of how to initiate structural change in wood burning behavior for households that cannot afford the upfront capital (even with the PSCAA's current wood stove replacement program) to purchase a certified woodstove or repair a non-working alternative fuel device, but do not qualify for financial assistance. It is estimated that approximately 1,907 households in the Tacoma-Pierce County nonattainment area may use a wood-burning device as a source of heat but do not have the financial means to switch to an alternative during burn ban days. These households do not qualify for low-income assistance programs (their income is above the 150% federal poverty line designation) and do not have the financial means to comply with the state mandate to stop using uncertified stoves by September 30, 2015. Under this program, a low-wage earning household would receive a grant equal to a 100% reimbursement of the cost to switch to more efficient alternatives either through the repair of an existing non-wood device or the replacement of an uncertified wood-burning device.

Additional Program Alternative

In addition to the two programs outline above, a third alternative – a Wood Stove Replacement Loan Program – was evaluated as a possible solution for long term wood stove compliance and the permanent reduction of PM_{2.5} emissions in the nonattainment area. The development of a low-interest rate wood stove replacement loan program with a local financial partner could provide the area with a program that would aim to help all households in any income range access funds to replace an uncertified wood stove with a cleaner, more efficient alternative.

PROGRAM EVALUATION

To assess the financial feasibility of the assistance programs, a series of [Excel-based financial models](#) were developed for an on-bill utility credit program and a wood stove replacement program for low-wage households. Based on the models, the following summary results emerge.

As expected, the annual program cost for the on-bill utility credit program is highly dependent on the number of burn ban days per year. With a daily cost of roughly \$9,700, if 10 percent of the eligible households receive assistance, the annual program cost ranges from \$71,780 in a year with a low number of burn ban days to \$275,157 for a year with a high number of burn ban days – a very wide range (see Table 1 below). In a “low year,” each household receives \$42 in financial assistance, in an “average year” \$98, and in a “high year” \$162. Particularly in the high year scenario, this amount will impact household budgets as it amounts to roughly 0.4% of household income for households at 150% of the federal poverty line (\$35,325 for a family of 4).

Table 1: On-bill utility credit program summary results

PROGRAM SUMMARY - UTILITY ON-BILL CREDIT			
	Low	Historic	High
Number of burn ban days per year	6	14	23
Total households participating	2,620	2,620	2,620
Average annual cost	\$ 71,780	\$ 167,487	\$ 275,157
Total cost of program (2 years)	\$ 143,560	\$ 334,974	\$ 550,314
Average subsidy per household	\$ 42	\$ 98	\$ 162

With 40% of low-wage earning households participating in the Wood Stove Replacement Grant program, the total cost over the three year program is \$3.8 million with an average cost of \$5,040 per household as summarized in the table below. By reducing the number of uncertified wood stoves in the area by 764, the resulting reduction in emissions is 17.88 tons of fine particulate or a 0.43 ug/m³ reduction to the 24-hour standard¹. Although this reduction may seem minor, the resulting public health cost savings far exceed the upfront capital investment. In a 2012 health benefit analysis, the EPA estimated that a reduction of one ton of PM_{2.5} results in \$280,000 in health benefits². These health benefits exceed the \$215,385 per ton cost of the low-wage earning household program.

Table 2: Low-wage earning wood stove replacement program summary results

PROGRAM SUMMARY - WOOD STOVE REPLACEMENT GRANT	
Total households participating	764
Average annual cost	\$1,283,520
Total cost of program (3 years)	\$3,850,560
Average cost per household	\$5,040
Maximum possible average daily particulate reduction at 10% participation rate (µg/m³)	0.43

¹ Fine particulate reduction estimates provided by Erik Saganic, PSCAA Air Resources Specialist on 4/18/13. Every 100 uncertified stoves and inserts replaced with a non-wood source of heat results in 2.34 tons of fine particulate per year reduced or 0.056ug/m³ reduction to the violating 24-hour standard concentration.

² Fann, Baker and Fulcher, *Characterizing the PM_{2.5}-related health benefits of emission reductions for 17 industrial, area and mobile emission sectors across the U.S. (2012)*. <http://www.epa.gov/airquality/benmap/sabpt.html>, accessed 5/21/13.

CONCLUSIONS

Based on this ex-ante assessment of program alternatives for providing financial assistance to reduce fine air particulates in the Pierce County nonattainment area, the following recommendations emerge.

First, although the burn ban subsidy associated with the *On-Bill Utility Credit program* would provide financial relief to some households, limited knowledge of households' potential compliance – even with the subsidy – diminish the anticipated effectiveness of the program in reducing burning on those days. The amount of reduction in PM_{2.5} levels in Table 1 assumes that everyone who is reimbursed complies with burn bans, when they previously didn't. In addition, there are more than two years remaining until the required removal of old, uncertified wood stoves in the nonattainment area. As such, this program provides temporary relief to households but will not ultimately address the non-certified wood stove removal challenge when households can burn wood at little to no cost. Research on behavioral change and household energy use suggests that policies aimed at changing habits are less effective than those aimed at changing the household infrastructure (i.e. certified stove, energy efficient appliances, etc.). For these reasons, the burn ban subsidy may not be the most effective program to achieve the agency's stated goals.

More promising is the proposed *Low Wage Household Wood Stove Replacement program*. This program can help to accomplish the long-term goal of changing wood-burning behaviors and permanently reduce fine particulate emissions through the removal of uncertified wood stoves. This not only helps to reduce PM_{2.5} emissions on burn ban days, but also permanently eliminates the source of emissions from the nonattainment area. In addition, this program targets low-wage earning households, a population that is currently underserved by existing weatherization and assistance programs. However, due to the limited funds available for this program and low anticipated participation, this program is only expected to reduce daily emissions by 0.43 ug/m³ – beneficial from a health perspective, but not nearly enough to move the region out of nonattainment. Therefore, the *Low Wage Household Wood Stove Replacement Program* must be used in conjunction with other weatherization and assistance programs in order for the PSCAA to meet its emission reduction target.

It is also recommended that consideration be given to a *Wood Stove Replacement Loan* program. This program could follow the Low Wage Household Wood Stove Replacement program to assist all Tacoma-Pierce County homeowners with the replacement of uncertified wood stoves as the September 30, 2015 deadline draws near. Ultimately, it is these long term solutions – ones that change behaviors both structurally and behaviorally – that will help bring Pierce County back into attainment.

ADDITIONAL INFORMATION

For the full report and analysis done for PSCAA, please read [“Puget Sound Clean Air Agency Residential Wood Smoke Reduction Initiative: Burn Ban Financial Assistance Ex Ante Program Assessment”](#) prepared on June 18, 2013.