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The Indiana Outdoor Wood Boiler Replacement Program

A Case Study for Utilizing Renewable Energy Technology

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Background

The Issue

Outdoor Wood Boilers (OWBs) are outdoor heat-transfer based heating systems that combust wood to generate heat. Used incorrectly, OWBs become sources of toxic emissions that endanger the health of local communities.

Though all OWBs produce particulate matter (PM) pollution, the amount of pollution produced by an OWB varies from model to model and increases significantly when the improper materials are burned. Average OWBs produce as much PM pollution per hour as 22 US Environmental Protection Agency (U.S. EPA) certified wood stoves, 205 oil furnaces or 8,000 natural gas furnaces (NESCAUM, 2006). The combustion of unapproved materials such as treated wood, plastic or household waste reduces the efficiency of the OWB and increases the release of a number of different pollutants into the air. Even burning proper materials can produce enough pollution to adversely affect human health. The smoke produced by an OWB contains a number of different harmful pollutants such as PM, carbon monoxide (CO), poly aromatic hydrocarbons (PAHs), oxides of nitrogen (NO_x), sulfur dioxide (SO₂), carbon dioxide (CO₂) and many more.

The health and environmental impacts of pollutants produced by OWBs, especially PM, have been extensively studied. PM is a complex mixture of particles, including dust, dirt, soot, smoke and droplets of liquid small enough to be inhaled. There are two different types of criteria PM: PM_{2.5}, which includes particulate matter that is 2.5 micrometers and smaller, and PM₁₀, which includes particles that are between 2.5 and 10 micrometers in size. PM_{2.5} particles are small enough to be inhaled deep into the lungs and cause increased asthma attacks, increased respiratory symptoms such as wheezing, coughing and difficult or painful breathing, chronic bronchitis, decreased lung function and even premature death.

Successful Programs

The Indiana Outdoor Wood Boiler Replacement Program (IN OWB Replacement Program) developed by the American Lung Association of the Upper Midwest (ALAUM) in partnership with the Hoosier Environmental Council (HEC), the U.S. EPA, the Indiana Department of Environmental Management (IDEM) and many community groups, is the first OWB replacement program to offer a 100% renewable, zero emission replacement option. Previous programs were voucher based and provided like-for-like replacements, meaning they incentivized the replacement of older, less efficient OWBs with newer and more efficient models.

The IN OWB Replacement Program was not only the first program to offer funding to replace OWBs with zero emission geothermal and combination geothermal/solar systems, but it also covered up to 100% of the eligible replacement costs. One of the largest barriers to the adoption of renewable, zero emission technologies is the initial equipment and installation costs. As a result, many of the homeowners who applied for

funding through the IN OWB Replacement Program would not have been able to afford replacing their OWBs with a geothermal or combination geothermal/solar system without a complete or high percentage of funding to cover the eligible costs.

As such, the IN OWB Replacement Program was designed to provide for up to 100% of the eligible costs for as long as funding was available. At the end of the funding cycle, the IN OWB Replacement Program was able to fully, mostly or partially fund a total of 15 replacement projects.

Program Implementation

System Research

The IN OWB Replacement Program was unique in that the replacement options included geothermal and solar systems. It was important to conduct system and market research ensuring that the replacement options were both technologically and financially feasible before the application period was opened. ALAUM created a list of Indiana geothermal and solar vendors to inform them about the IN OWB Replacement Program. Vendors that responded positively were sent an online link or a paper copy of a survey requesting information about the technology and programmatic opportunities, including:

- Average system costs
- Average system life expectancies
- Average savings observed after system installation
- Annual maintenance costs
- Vendor service areas
- Realistic application and installation timeline expectations
- Estimated costs
- Average operation costs
- Permission to post vendor contact information on the IN OWB Replacement Program website

The vendor's responses were compiled and analyzed to ensure that the proposed implementation and funding structures would meet the goals of the program before publicly launching the IN OWB Replacement Program.

Marketing and Advertising

ALAUM worked to develop a marketing strategy targeting and benefiting interested populations, including the La Porte County Health Department, U.S. EPA Region 5 and U.S. EPA Headquarters.

ALAUM collaborated with IDEM and several county health departments to obtain lists of OWB owners throughout the State of Indiana. These lists were used to send direct mailers to homeowners informing them of this unique funding opportunity. The La Porte County Health Department was particularly effective in their efforts to aid the disseminate

information about the IN OWB Replacement Program. Their staff members devoted a considerable amount of time ensuring La Porte County OWB owners knew that the IN OWB Replacement Program was available to them. The result was the submission of more applications for funding in La Porte County than any other county in the state.

Website Development

ALAUM developed a website (<http://www.ItsDoableGoRenewable.org/>) to share information about the program for potential program participants and vendors. The website includes general information about the renewable replacement options, health effects of exposure to smoke produced by OWBs, general program application information and an interactive map of participating Indiana renewable energy vendors.

Vendors could also submit their company and contact information through an online form to have it added to the interactive map of participating vendors.

Program Applications

ALAUM developed a comprehensive program application that included a short questionnaire to aid HEC and ALAUM in evaluating the applications, including:

- Applicant's income category
- Location of the OWB & proximity to neighbors, schools or community areas
- Number of cords (or amount) of wood burned per year
- Reason for applying
- Annual cost to operate the OWB
- Whether or not the OWB supplied hot water in addition to space heating

Program Application Evaluation

The application period for the IN OWB Replacement Program began in mid-October, 2015 and extended through December 31, 2015. Any homeowner in Indiana that owned and operated an OWB was eligible to apply for the IN OWB Replacement Program. At the end of the 3 month application period, ALAUM had received a total of 82 applications.

Applications were evaluated based on a number of factors, including, but not limited to:

- Cost effectiveness
- Proximity to homes, schools, healthcare facilities
- Applicant income category
- Potential health impacts

Funding Strategy

The IN OWB Replacement Program distributed awards based on a rolling funding system. If an offered award was declined by the homeowner, the funds were immediately offered

to the next applicant selected using the evaluation criteria. The total IN OWB Replacement Program's funding allotted to program awards was \$419,000.

Projects

All 15 replacement projects were awarded geothermal systems to provide for the homeowner's indoor home conditioning needs. In addition to the geothermal systems, 4 replacement projects were also awarded solar arrays of varying sizes to provide a supplemental supply of electricity to meet the electricity demands of the geothermal systems.

Emissions and Health Benefits

The IN OWB Replacement Program resulted in quantifiable and permanent reductions in criteria air pollutant and air toxics emissions in Indiana. These reductions are experienced not only in residential areas in close proximity to the original OWB, but also in downwind areas where the emissions travel. To determine airborne emissions from the OWB point sources, ALAUM used an equation developed by U.S.EPA that included the average number of cords of wood burned per year, number of hours of operation for each unit and the type of material (wood) that was burned.

The U.S.EPA COBRA program is a screening tool that provides estimates of ambient air pollution concentrations based on user-designated reductions in emissions. The results are translated into human health related outcomes and healthcare spending reductions. The COBRA program utilizes exposure to PM_{2.5} exclusively; as OWBs also emit other criteria pollutants, the estimates given for healthcare spending reductions may be conservative.

Emission reductions were applied to the county and state in tons per year. Any corresponding emissions reductions in the surrounding region were also factored into the health-based outcomes and monetary spending reductions. COBRA is able to apply unique reduction values in up to 10 individual counties. Emissions from Dubois and Warrick counties were combined in order to reach the 10 county limit.

Total state healthcare spending reductions for Indiana reflect savings from all state counties including those that did not have participants in the program. This is the result of a reduction in airborne emissions that are transported to state counties in close proximity to those that participated in the IN OWB Replacement Program.

Healthcare savings include cost reductions for the following criteria: adult mortality, infant mortality, non-fatal heart attacks, respiratory hospital admissions, cardiovascular hospital admissions, acute bronchitis, upper respiratory symptoms, lower respiratory symptoms, asthma ER visits, minor restricted activity days, work days lost, and asthma exacerbations. The monetary value for each of these criteria was identified by using direct medical costs, statistical value of life calculations, and average cost-of-illness criteria. The

table below details the precise emissions reductions, as calculated using the point-source equation provided by U.S. EPA, along with the healthcare spending reductions calculated through the COBRA program.

County	Number of Units Replaced	PM2.5 Reduction (t/yr)	Healthcare Spending Reduction (Lower) (\$/yr)	Healthcare Spending Reduction (Upper) (\$/yr)
Cass	1	0.12	3,242.94	7,347.56
Franklin	1	0.04	606.39	1,371.68
Harrison	1	0.05	1,165.40	2,638.31
La Porte	4	0.32	14,313.69	32,396.39
Lake	1	0.13	26,263.49	59,478.90
Lawrence	1	0.16	6,377.71	14,445.72
Marshall	1	0.05	2,411.18	5,458.39
Monroe	1	0.24	15,708.61	35,787.70
Morgan	1	0.11	6,642.98	15,000.21
Dubois/Warrick	2	0.13	2,715.24	6,137.30
State Total	14*	1.35	149,242.01	337,908.28

*There were 15 total participants in the program but one did not report the number of cords that had previously been used so an emissions reduction estimate was not made.

Future Plans

The IN OWB Replacement Program was funded through a private, finite grant. However, ALAUM is confident that with additional funding and resources, this program could be replicated in the future.

Conclusion

The IN OWB Replacement Program was designed to meet a specific need for an OWB replacement program that included a zero emission, renewable option. The overwhelming success of the IN OWB Replacement Program can be attributed to funding 100% of the eligible costs to replace an OWB with a geothermal or combination geothermal/solar home conditioning system.

The IN OWB Replacement Program was able to successfully replace a total of 15 OWBs in Indiana, which will contribute to the reduction of 1.35 tons per year of PM2.5 emissions and up to approximately \$337,908.28 in healthcare spending per year.



For more information, visit:

[Www.ItsDoableGoRenewable.org](http://www.ItsDoableGoRenewable.org)

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