ECONOMIC IMPACT ANALYSIS

An Extension Community Economics Program

The Economic Impact of Minnesota's Weatherization Programs: A Statewide Input-Output Analysis

Prepared by:

Brigid Tuck and David Nelson

University of Minnesota Extension Center for Community Vitality

July 2010

UNIVERSITY OF MINNESOTA
EXTENSION
Driven to Discover℠

The Economic Impact of Minnesota's Weatherization Programs
Table of Contents

This report is the result of collaboration among University of Minnesota Extension, the Minnesota Community Action Partnership, and the Minnesota Department of Commerce, Office of Energy Security. Primary researchers for the University of Minnesota are Brigid Tuck and David Nelson of the Extension Center for Community Vitality. Bill Lazarus, Elton Mykerezi, and George Morse of the Department of Applied Economics provided peer reviews of the draft report. Karen Moe of the Minnesota Community Action Partnership provided information and feedback as the liaison for the project. Mary Vitcenda of Extension edited the final draft.

The authors wish to thank the individual community service providers for participating in the online survey that forms the basis for this study. The Minnesota Community Action Partnership and the Minnesota Department Commerce, Office of Energy Security funded the study.

The Economic Impact of Minnesota's Weatherization Programs:
Executive Summary

A recent economic impact analysis concludes weatherization work has a meaningfully significant impact on Minnesota communities. The impacts vary by region and by weatherization activity, but on average the programs create one additional dollar of economic output with every dollar of spending. This heightened impact is likely attributable to the availability of manufacturers and suppliers of weatherization products in Minnesota and to the vast network of weatherization service providers throughout the state.

Approach

In order to quantify the economic impact of Weatherization Assistance Programs (WAP), University of Minnesota researchers used an input-output model. The model traces the flow of dollars throughout on economy and quantifies the economic effects (in dollars and employment) of spending for a specific activity. To get a true measure of regional weatherization spending activities, individual weatherization assistance program service providers in Minnesota were surveyed. The input-output model was customized to reflect the individual provider responses. The input-output model was created using IMPLAN software and data.

Findings

WAP enables low-income families to permanently reduce their energy bills by making their homes more energy efficient. The long-lived improvements of weatherization services result in substantial benefits for weatherization clients while improving the health and safety of their homes. In addition, WAP generates economic activity in the local economy

Research indicates that:

- For every dollar spent in Minnesota on weatherization programs, an additional $1.09, on average, of economic activity is created in the state.
- For each direct job funded by the program, an additional 0.77 jobs are generated in the state.
- For every dollar earned by weatherization workers, an additional $0.86, on average is earned by other workers in the state.

Additional Weatherization Value

This analysis focuses only on the economic value generated per $1 of weatherization spending. These results hold true regardless of the funding source (federal, ARRA stimulus, etc). There is also a value to the dollars saved in energy costs and of social, physical and health improvements – which is not included in this study.

Introduction

A network of local community action service providers, nonprofit organizations, Native American Tribal governments, local governments and the state government collaborate in Minnesota to implement the U.S. Department of Energy's Weatherization Assistance Program (WAP). By making homes more energy efficient, WAP enables low-income families to permanently reduce their energy bills. Under the program, the energy performance of dwellings is improved using the most advanced technologies and testing protocols available in the housing industry. As a result, low-income families decrease monthly expenditures for items like heating, cooling, and electricity, while also reducing the overall amount of energy used across the country. According to the U.S. Department of Energy "because the energy improvements that make up weatherization services are long lived, the savings add up over time to substantial benefits for weatherization clients and their communities, and the nation as a whole."

Weatherization programs clearly demonstrate social, physical, and health benefits for participants. Research shows that on average, low-income families can save $350 per year in energy costs by participating in the program. Research also demonstrates that weatherization programs improve the energy climate within homes, making them more comfortable for their inhabitants, as well as reducing national—and even global—energy use.

Weatherization programs also provide an economic benefit to host communities through spending for materials and for labor to perform weatherization services. Since a network of local service providers delivers the programs, much of the spending for inputs is local and many of the individuals employed are local residents, thus creating a local economic impact.

However, while there exists considerable research on the social, physical, and health benefits of weatherization programs, little research focuses on the economic impact of these programs, particularly in Minnesota. Thus, the Minnesota Community Action Partnership engaged the University of Minnesota to conduct an Economic Impact Analysis program. The program provides the results of analysis in two formats: a written report and a facilitated discussion. This document is the written report and addresses the question "What is the economic impact of weatherization programs in Minnesota?"

This document is one component of a larger study examining the economic impact of weatherization programs in Minnesota. In addition to this report, there are factsheets highlighting the economic impact of weatherization programs for each of the 32-weatherization service providers.

Weatherization Procedures

The Minnesota Department of Energy Security recognizes seven basic weatherization procedures performed in the state: baseloads, building insulation, doors and windows, general heat waste and air infiltration, HVAC systems, general repairs, and health and safety. Table 1 lists these procedures and provides a general description of each.

Expenditures for each weatherization procedure vary depending on required inputs. Some procedures require more labor and others more material inputs. The material input purchases, including items like furnaces, ductwork, and refrigerators, also vary depending on the procedure. Finally, the expenditures for each procedure differ based on the service provider performing the weatherization. Therefore, the first step of this economic impact analysis is to determine an average breakdown of expenditures (materials versus labor) by each weatherization procedure for the state. The second step is then to determine the commonly purchased material inputs for each procedure.

This analysis thus begins with a survey of the 32-weatherization service providers in Minnesota. In winter 2009, each service provider was e-mailed an invitation to an online survey. The survey asked a series of questions about expenditures for each procedure.[1] Survey participants indicated what percentage of their budget for each procedure historically has gone to labor versus material purchases. Survey participants also listed the top three materials typically purchased for each procedure.

The survey results provide the framework for determining the direct, or initial, impact of weatherization programs. Since this study focuses on the marginal economic impact (a $1 change) instead of the overall economic impact (millions of dollars in change) of weatherization programs, these results comprise the direct impact. [2]

Table 1 presents the results of the first step, or the state average breakdown of material versus labor expenditures.[3] According to service providers, 65 percent of spending for baseload work goes to materials, while 35 percent is for labor. This indicates that baseload work is input-intensive. Meanwhile, the results show that health and safety work is more labor-intensive with 65 percent of spending invested in labor and only 35 percent in material inputs.

[1] See the appendix for a copy of the survey.
[2] See the Methodology section for more on how the direct impact is calculated.
[3] Table 1 reflects spending profiles for the state of Minnesota. Spending profiles for individual service providers will vary.

Table 1: Minnesota Weatherization Procedures and Expenditure Profiles

Procedure Name	Procedure Description	Breakdown Ratio	Breakdown Description
Baseloads	Cost-effective measures pertaining to water heaters, refrigerators, and lighting.	65% 35%	Materials Labor
Building Insulation	Any insulation of walls, attics, crawl spaces, mobile home bellies, sub-floor area, etc.	42% 7% 2% 49%	Insulation Products Vents, Fans & Plastic Windows and Doors Labor
Doors and Windows[4]	Replacements of doors and windows.	54% 46%	Materials Labor
General Heat Waste and Air Infiltration	Air-sealing measures that reduce or eliminate cold air from getting into a heated space and warm air from escaping from heated to the unheated space or outdoors.	30% 70%	Materials Labor
HVAC Systems	Cost-effective repairs/replacements for mechanical systems components, such as furnaces.	53% 47%	Materials Labor
General Repairs	Repairs necessary for the effective performance or preservation of weatherization materials.	27% 73%	Materials Labor
Health and Safety	Energy-related health and safety concerns that need to be remedied before, or because of, the installation of weatherization materials.	35% 65%	Materials Labor

[4] While Doors and Windows is included as a procedure type, it should be noted that doors and windows are not typically installed using weatherization funds due to the low energy savings and Savings-To-Investment Ratio (SIR) calculations required on these measures.

Table 2 presents the results of the second step, a list of the most commonly purchased material inputs. Weatherization providers report that water heaters, refrigerators, and insulation are the most purchased items to perform baseload work, while fans, smoke detectors, and venting supplies are the most purchased for health and safety work.

Table 2: Top Material Expenditures by Procedure	
Procedure	**Most Frequently Purchased Materials**
Baseloads	Water Heaters, Refrigerators, and Insulation
Building Insulation	Cellulose, Fiberglass, and Foam
Doors and Windows	Doors and Windows
General Heat Waste and Air Infiltration	Caulk and Weather-Stripping
HVAC Systems	Furnaces and Ductwork
General Repairs	Sheetrock, Lumber and Roofing Supplies
Health and Safety	Fans, Smoke Detectors, and Venting

Prepared by University of Minnesota Extension Center for Community Vitality

Thus, the survey data provides the framework for the determination of the direct impact. Given this direct impact, the third step of this analysis is to enter the data into an input-output model that measures how the direct spending of the weatherization service providers creates additional economic activity in the state. This is the heart of the economic impact analysis.

Economic Impact Analysis

Weatherization Procedures Impacts

The first two steps of this analysis determine the direct impact of each procedure. The third step enters this data into an input-output model that traces the flow of dollars throughout an economy and quantifies the economic effects (in dollars and employment) of spending for a specific activity, such as weatherization. This analysis uses the IMPLAN (Minnesota IMPLAN Group) data and software.

As mentioned earlier, this analysis focuses on a marginal ($1) change in spending. This analysis also uses a modeling technique called analysis-by-parts. In analysis-by-parts, material input spending is entered as an industry change while spending by labor is entered as a labor income change. The analysis assumes that all weatherization dollars are spent within the state of Minnesota and that all weatherization workers are Minnesota residents. A more in-depth explanation of the procedures used for this analysis is in the Methodology section.

Table 3 shows the output impact of weatherization program spending. On average, $1 of spending on weatherization procedures in Minnesota generates an additional $1.09 of economic output in the state. However, the impact varies by procedure. For example, $1 of spending on the baseload procedure results in $1.20 of additional economic output in the state, while $1 spent on health and safety generates 78 cents in additional activity.

Table 3: Output Effects of Weatherization Procedures in Minnesota

Procedure Type	Direct Effect (Dollars)	Total Effect (Dollars)
Baseloads	$1.00	$2.20
Building Insulation	$1.00	$2.08
Doors and Windows[5]	$1.00	$2.41
General Heat Waste and Air Infiltration	$1.00	$1.94
HVAC Systems	$1.00	$2.14
General Repairs	$1.00	$2.08
Health and Safety	$1.00	$1.78
Average for All Procedures	$1.00	$2.09

Prepared by University of Minnesota Extension Center for Community Vitality

[5] While Doors and Windows is included as a procedure, and in some cases may appear to have significant economic impact, it should be noted that doors and windows are not typically installed using weatherization funds due to the low energy savings and Savings-To-Investment Ratio (SIR) calculations required on these measures. The economic impact is due to the large number of window and door manufacturers located in the state.

The economic impact calculation method explains differences in the economic impact among procedures. In Table 3, the direct effect represents $1 of actual spending on weatherization programs. The total effect is the direct effect plus the indirect and induced effects. Purchases for material supplies by the weatherization provider, or its contractor, generate indirect effects. The material supplier increases its output and thus increases demands to its own supplier. Therefore, total output increases and is captured as the indirect effect in the modeling software.

Induced effects are the result of spending by weatherization service provider (and contractor) *employees* that occurs because the employees earn wages. The employees spend these wages on groceries, legal services, and household services, for example, thus triggering additional economic impact. The model captures this spending as the induced effects. The size of the indirect and induced effects varies depending on the availability of local goods and services for purchase by both the weatherization provider and the workers.

Table 4 shows the impact of weatherization programs on employment in Minnesota. On average, every one person implementing weatherization procedures creates an additional 0.77 jobs in the state economy.

Table 4: Employment Effects of Weatherization Procedures in Minnesota

Procedure Type	Direct Effect (Jobs)	Total Effect (Jobs)
Baseloads	1.0	1.92
Building Insulation	1.0	1.66
Doors and Windows	1.0	1.87
General Heat Waste and Air Infiltration	1.0	1.77
HVAC Systems	1.0	1.78
General Repairs	1.0	1.74
Health and Safety	1.0	1.68
Average for All Procedures	1.0	1.77

Prepared by University of Minnesota Extension Center for Community Vitality

As Table 4 reflects, economic impacts vary by procedure. This is due to a variety of factors, including the percent of spending for materials versus labor, the availability of local supplies, the productivity of supplying industries, and the wage structure of supplying industries.

For example, the baseload procedure has the highest impact on employment and the highest materials-to-labor ratio. It may be that the material input supplying industries have higher wages than industries that provide supplies to weatherization workers. It is possible that since more dollars flow to

manufacturers than to weatherization workers, the baseload procedure has a greater impact on jobs.

On the other hand, the building insulation procedure has the least job impact of all the procedures. According to Table 1, nearly half of the money spent on the procedure goes to labor, while the other half goes to material purchases. The low impact may be because building material supplies are not manufactured in Minnesota. It may also be because the weatherization workers dollar has fewer ripple effects in the economy than spending for material inputs.

Table 5 details the economic impact of weatherization programs and procedures on labor income. On average, every $1.00 paid to individuals performing weatherization work creates an additional 86 cents in labor income in the state economy.

Table 5: Labor Income Effects of Weatherization Procedures in Minnesota

Procedure	Direct Effect (Dollars)	Total Effect (Dollars)
Baseloads	$1.00	$1.98
Building Insulation	$1.00	$1.76
Doors and Windows	$1.00	$2.01
General Heat Waste and Air Infiltration	$1.00	$1.83
HVAC Systems	$1.00	$1.93
General Repairs	$1.00	$1.77
Health and Safety	$1.00	$1.71
Average for All Procedures	$1.00	$1.86

Prepared by University of Minnesota Extension Center for Community Vitality

The analysis shows that weatherization programs have a meaningfully significant economic impact in Minnesota. Every dollar spent on weatherization programs in Minnesota, on average, creates an additional $1.09 in output. The employment of one individual performing weatherization work results in another 0.77 individuals working in other industries in the state. Finally, every dollar earned by a weatherization worker creates an additional 86 cents in labor income in the state.

It is critical to remember that economic impacts are unique to the specific situation. The economic impacts in this report reflect the economy of the state of Minnesota and the spending profiles developed. Thus, they can only be applied to weatherization programs at the state level in Minnesota. They do not apply to other states or to individual counties or regions within Minnesota. This report is one component of a study that includes individual factsheets that highlight the economic impact of weatherization programs within each service provider's service area. Those factsheets should be used to determine the economic

impact at a regional level. However, these results do apply to all weatherization dollars regardless of funding source (federal or stimulus).

American Recovery and Reinvestment Act (ARRA) Capital Investment Impacts

In addition to the dollars spent on weatherization procedures themselves, the American Recovery and Reinvestment Act (ARRA) stimulus funding provides weatherization service providers with money to make capital and equipment investments. The survey of Minnesota's weatherization service providers reveals that they have and plan to continue taking advantage of the opportunity to replace, upgrade, and purchase equipment and tools. According to survey results, the most popularly purchased items include blower doors, vehicles, auditing and testing equipment, and safety equipment. This study does not address or analyze the dollars allocated to capital and equipment investments.

Methodology

Input-Output Models

Special models, called input-output models, exist to conduct economic impact analysis. There are several input-output models available. IMPLAN (IMpact Analysis for PLANning, Minnesota IMPLAN Group)[6] is one such model. Many economists use IMPLAN for economic contribution analysis because it can measure output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations and qualifications, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities, and its limitations will help ensure the best results from the model.

One of the most critical aspects of understanding economic impact analysis is the distinction between the "local" and "non-local" economy. The local economy is identified as part of the model-building process. Either the group requesting the study or the analyst defines the local area. Typically, the study area is a county or a group of counties that share economic linkages.

A few definitions are essential in order to properly read the results of an IMPLAN analysis. The terms and their definitions are provided below.

Output

Output is measured in dollars and is equivalent to total sales. The output measure can include significant "double counting." Think of corn, for example. The value of the corn is counted when it is sold to the mill, again when it is sold to the dairy farmer, again as part of the price of fluid milk, and yet again when it is sold as cheese. The value of the corn is built into the price of each of these items and then the sales of each of these items are added up to get total sales (or output).

Employment

Employment includes full- and part-time workers and is measured in annual average jobs. IMPLAN includes total wage and salaried employees, as well as the self-employed, in employment estimates. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric.

Labor Income

Labor income measures the value added to the product by the labor component. So, in the corn example when the corn is sold to the mill, a certain percentage of the sale goes to the farmer for his/her labor. Then when the mill sells the corn as feed to the dairy farmer, it includes some markup for its labor costs in the price. When the dairy farmer sells the milk to the cheese manufacturer, he/she includes a value for his/her labor. These individual value increments for labor can be

[6] IMPLAN Version 3.0 is used in this analysis. For the full report, the data set for Minnesota 2008 is employed. The individual factsheets apply the 2008 data for those counties. The trade flows model with SAM multipliers is implemented.

measured, which amounts to labor income. Labor income does *not* include double counting.

Direct Impact

Direct impact is equivalent to the initial activity in the economy. In this study, it is spending by the weatherization service provider and/or its contractors.

Indirect Impact

The indirect impact is the summation of changes in the local economy that occur due to **spending for inputs** (goods and services) by the industry or industries directly impacted. For instance, if employment in a manufacturing plant increases by 100 jobs, this implies a corresponding increase in output by the plant. As the plant increases output, it must also purchase more inputs, such as electricity, steel, and equipment. As the plant increases purchases of these items, its suppliers must also increase production, and so forth. As these ripples move through the economy, they can be captured and measured. Ripples related to the purchase of goods and services are indirect impacts.

Induced Impact

The induced impact is the summation of changes in the local economy that occur due to **spending by labor**, that is spending by employees in the industry or industries directly impacted. For instance, if employment in a manufacturing plant increases by 100 jobs, the new employees will have more money to spend to purchase housing, buy groceries, and go out to dinner. As they spend their new income, more activity occurs in the local economy. This can be quantified and is called the induced impact.

Total Impact

The total impact is the summation of the direct, indirect, and induced impacts.

Procedures Implemented in this Analysis

Since the goal of this study is to determine the marginal impact of a dollar of spending on weatherization procedures and not to look at the total dollars spent on weatherization programs, the report uses a slightly different analysis approach than typical economic impact studies.

A typical economic impact study starts with a total spending dollar figure. Total spending is divided among its component parts and entered into the IMPLAN model for analysis. This analysis has no total spending dollar figure; therefore, it establishes a proxy.

The analysis assumes that $10 million is spent on each procedure. For example, the state expenditure pattern shows that for the baseload procedure 65 percent of expenditures were for materials and 35 percent for labor (see Table 1). Thus, an expenditure of $6.5 million is entered into the model as a material expenditure and $3.5 million as a labor expenditure.

When entering material expenditures into the model, the list of most frequently purchased items is used to determine which manufacturing sectors are impacted (see Table 2). For the individual factsheets, 20 percent of the total material input expenditure is assigned to each manufacturing sector.

So, to follow the example, of the $6.5 million spent on baseload materials, the model reflects $1.3 million going to water heater manufacturing, $1.3 million to refrigerator manufacturing, and $1.3 million going to insulation manufacturing. The balance is then assigned to the wholesale sector. If the manufacturing industry does not exist in the region, the 20 percent for that manufacturing sector is also assigned to the wholesale sector.

The only exception to this is the doors and windows procedure where 100 percent of the expenditure is assigned to window and door manufacturing. Since all manufacturing sectors exist on a state level, for the state report 100 percent of the expenditure for materials is assigned to the manufacturing sector. Further, for the individual factsheets, a percent of local purchases is applied.

Weatherization directors indicate in the survey how much they purchase locally, and this is used to determine what percentage of the total expenditures is local. For the baseload procedure, if the weatherization director indicates that 90 percent of expenditures are within their service provider's region, then it is assumed total expenditures for baseloads was $5.85 million (0.9 times $6.5 million).

Labor expenditures are entered into the model as a labor income change. All labor expenditures are assumed to be in the form of employee compensation and all employees performing weatherization work are locally based.

Entering the direct effects of materials and labor separately is a procedure known as analysis-by-parts. Following this procedure, the total impact of spending on

material expenditures are the indirect impacts and the total impact of spending on labor expenditures are the induced impacts.

Conclusions

In conclusion, weatherization programs have a meaningfully significant economic impact in Minnesota. Every dollar spent on weatherization programs in Minnesota, on average, creates an additional $1.09 in output. The employment of one individual performing weatherization work employs another 0.77 individuals in other industries in the state. Finally, every dollar earned by a weatherization worker, creates an additional $0.86 in labor income in the state.

The economic impact of weatherization programs varies by geography, availability of products, local purchasing, the structure of the supplying industries, and the ratio of labor to materials. Due to this variability, ***one must exercise extreme caution in interpreting these results.*** The results of this study apply only to the weatherization procedures at the state level. They cannot be applied to individual counties or clusters of counties within the state. They also apply only to the state of Minnesota and should not be applied in other states.

Appendix: Weatherization Procedures Survey

1. Please **modify** the following breakdowns according to actual expenditures (use your best guess) by your service provider for weatherization procedures (to the nearest 5%):

Procedure	Description	%	Breakdown Description
Baseloads	Cost-effective measures pertaining to water heaters, refrigerators, and lighting.	80% 20%	Materials Labor
Building Insulation	Any insulation of walls, attics, crawl spaces, mobile home bellies, etc.	30% 10% 60%	Insulation Products Vents, Fans & Plastic Labor
Doors and Windows	Replacements of doors and windows.	45% 55%	Windows/Doors Labor
General Heat Waste and Air Infiltration	Air-sealing measures that reduce or eliminate cold air from getting into a heated space and warm air from escaping from heated to the unheated space or outdoors.	15% 85%	Materials Labor
HVAC Systems	Cost-effective repairs/replacements for mechanical systems components, such as furnaces.	50% 50%	Materials Labor
General Repairs	Repairs necessary for the effective performance or preservation of weatherization materials.	15% 85%	Materials Labor
Health and Safety	Energy-related health and safety concerns that need to be remedied before, or because of, the installation of weatherization materials.	20% 80%	Materials Labor

2. What percent of your materials do you buy (to the nearest 5%):
    a. Within your CAA region?
    b. Outside of your CAA region?

3. Do you
    a. Employ your own work crews for
        i. Baseloads
        ii. Building Insulation
        iii. Doors and Windows
        iv. General Heat Waste and Air Infiltration
        v. HVAC Systems
        vi. General Repairs
        vii. Health and Safety?
    b. Employ outside contractors?
        i. What percent are from within your CAA region?

4. For each procedure, please list the top three materials purchased.
    a. Baseloads
    b. Building Insulation
    c. Doors and Windows
    d. General Heat Waste and Air Infiltration
    e. HVAC Systems
    f. General Repairs
    g. Health and Safety

5. Do you plan to make any capital investments/purchases (new work trucks, ladders, etc) with ARRA funding?
    a. If yes, what items are on your list?