

# Missoula Housing WRAP Blueprint

(**W**eatherization and **R**etrofit **A**ssistance **P**rogram)

*A blueprint for a community-driven household energy efficiency program*

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## Executive Summary

The Missoula Housing Weatherization and Retrofit Assistance Program (WRAP) is a collaborative, community-driven initiative designed to provide free household energy audits and retrofits to help low-income City of Missoula residents reduce utility expenses and thereby relieve financial stress. On average, low-income households have been found to spend about 20% of their income on household energy bills and risk having to choose between buying food and paying energy bills. Although various energy assistance programs exist, participation rates are low and capacity to address the need is inadequate. Moreover, few programs seek to reduce energy costs and address some of the root causes, and thus do little to reduce dependency. Fewer still address these challenges entirely through community collaboration.

Impetus for the WRAP program came from a general, public acknowledgement of these challenges facing low-income households in Missoula as a social and economic justice issue. The program was conceived as a means of building on the success of the 2008-2010 Green Blocks program through the development of a durable, community-driven program that is also designed to alleviate the problem of housing affordability, help support the local economy by increasing household spending ability, and help reduce the community's greenhouse gas (GHG) emissions, i.e. Missoula's carbon footprint.

WRAP is collaboration among local organizations, institutions, the business community and residents. WRAP was designed entirely through local input and involvement of the primary partners and advisors including Missoula College, Homeward, the Human Resource Council, the Environmental Studies Program at The University of Montana, local energy retrofit contractors, and City employees.

This document is intended to be a plan or blueprint for the implementation of a year-long pilot project to test the individual deliverables of each partner, to solidify the collaboration among partners and the community, and to develop financial viability of an adaptable WRAP program that would be implemented annually.

The first year of the program, proposed to begin in January, 2015, would function as the pilot project and is the focus of the WRAP Blueprint. The pilot project would serve about 20 households in the Franklin to Fort neighborhood. As conceived, the pilot project will serve as a proof of concept of collaboration among partner organizations, as well as an opportunity to address any issues or roadblocks not predicted in the original program design.

The WRAP program combines the direct service delivery capabilities within the Missoula College Industrial Technology Department, educational outreach tools of Homeward, and the technical expertise of the Human Resource Council to provide home energy audits and retrofits, as well as education, to households in low-income neighborhoods at no cost to recipients. The WRAP Blueprint also includes an outreach facilitation role for the Missoula Neighborhood Council. WRAP is currently designed to serve roughly 20 households in a year, repeating each year in a separate neighborhood, and to be adaptable to different neighborhood needs and timelines.



This document includes the following:

- A brief history of program conception and development;
- Descriptions of partner roles and responsibilities;
- A timeline for the entire WRAP program and the initial pilot project, which constitutes the first year of the full program;
- An outline of the WRAP program technical framework for the audits and retrofit;
- Proposed pilot and full program funding options;
- Further considerations including: liability and supervision; timing and commitments; communications and outreach; and program flexibility;
- Recommendations and next steps; and
- Case examples of successful programs from other cities.

Immediate next steps for program development include:

1. Obtaining official endorsements;
2. Further establishing individual partner deliverables;
3. Formally adopting the Blueprint via a Memorandum of Understanding (MOU) between partner organizations and the WRAP coordinator's home organization;
4. Identifying a "lead" partner organization;
5. Further determining financial need and obtaining funding for pilot project;
6. Establishing a designated WRAP Coordinator position;
7. Filling the WRAP Coordinator position; and
8. Carrying out the pilot project.

Longer-term steps involve evaluating the pilot project and securing longer-term funding and/or identifying a continuous financing mechanism.

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## Introduction

Residential energy audit and retrofit programs are not new; at the federal, state, and local level, a host of programs offers both technical and financial assistance to homeowners hoping to reduce energy costs.<sup>1</sup> These energy efficiency programs are proven (see Appendix: Case Examples) to offer positive economic savings and environmental benefits with low upfront capital and minimal resources. Yet, due to increasing demand for these programs, community resources have not kept up the local supply of affordable energy assistance.<sup>2</sup> Best practices suggest that a sustainable approach to delivering energy efficiency services, particularly to low-income households, is through a highly participatory framework built on relationships among local government, NGOs, private companies, and academic institutions. This blueprint is the result of such a collaborative and feedback-driven process with local nonprofits, businesses, city government, and The University of Montana (UM).

This energy efficiency program Blueprint focuses on the crucial elements needed for implementing a community-driven pilot project in the City of Missoula, MT, and for the implementation of a full WRAP program based on pilot project experiences and results. The program offers the opportunity to not only build social capital and capacity in the city, but also a methodology for approaching both environmental and social justice issues. This blueprint is intended as a living and flexible document that has additional content added as partnerships are further developed and best practices discovered. Though a large amount of legwork and research has been done, continued effort in partner coordination, endorsement, fund-raising and implementation is required to successfully achieve Missoula Housing WRAP's objectives.

### A. Program Origins and Current Status

WRAP development began after University of Montana Environmental Studies (EVST) graduate students who attended the Missoula Climate Summit on September 25, 2013, noted Missoula Mayor John Engen's enthusiasm for developing a program to address energy efficiency in low-income households as a social justice issue.<sup>3</sup> Students, as part of the Local Solutions to Climate Change class taught by UM professor Robin Saha, subsequently researched case studies of such programs in Missoula, such as the Green Blocks energy retrofit program,<sup>4</sup> and in other cities (see Appendix: Case Examples). Students met with local home energy experts and presented their initial findings and recommendations to the Mayor and Conservation Grants Administrator Chase Jones in a meeting on October 28, 2013.

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<sup>1</sup> A study from the early 2000s estimated that low income households in the United States spent, on average, 19.5% of their income on energy costs, compared to 4.6% in median-income households (NLIEC 2002). The DOE estimates annual household savings from participation in energy auditing and retrofit programs nationwide to be about \$437 (US DOE 2013).

<sup>2</sup> Nationally less than one million households of over 38 million that qualify took part in federal energy assistance programs, many of which were dependent on one-time federal Recovery Act fund. Of the three-quarters of a million low-income households that participated since 2009, only approximately 7,000 were in Montana (Madrid 2012).

<sup>3</sup> This idea was consistent with Mayor Engen's Housing Initiative, which focuses on improving access to affordable housing for low-income families, and his Strategic Plan, which mentions energy efficiency and sustainability several times (City of Missoula 2013).

<sup>4</sup> See Szpaller 2010 and Jones & Merriam 2010.



Because city capacity to support the design and development of such a program is limited, any major effort to lay the groundwork for such a program would need to come from local organizations. The Mayor requested that the students prepare a “blueprint” of a plan to address energy efficiency in low-income households for the Mayor’s consideration.

Students spent the next month finding and meeting with potential partner organizations in Missoula, gradually developing a plan that incorporates the advice and addresses the concerns of all partners. A draft plan combining the efforts of at least five local partner organizations and institutions was agreed upon by all partners in December 2013, and was submitted to Robin Saha and Chase Jones for review and revision. In January 2014, McDonough presented a revised Blueprint to and received endorsement from the Missoula Energy and Climate Team (an advisory group to the Missoula City Council Parks & Conservation Committee). Further official endorsements are currently being sought and various other next steps identified are described below.

WRAP development is currently being coordinated by Peter McDonough. The Blueprint was officially endorsed by the Missoula Energy and Climate Team on February 13, 2014. Partners are currently holding meetings to formalize technical, financial, and administrative details of the WRAP pilot project, which is expected to begin in January, 2015, and continue through the end of the year. The current WRAP Blueprint (this document) is the collective, unofficial agreement of partner organizations and reflects a collaborative effort from the beginning of its development.

## **B. Blueprint Description**

The purpose of this document is to serve as plan or blueprint to provide guidance for the WRAP Coordinator, partner organizations, and sponsors. Included below is a description of the partner organization roles and responsibilities, a proposed timeline for the pilot project, possible funding options, a general description of the audits and retrofits to be performed, further considerations, next steps, contact information for all affiliates, and examples of similar programs in other cities. As a living document, this blueprint is subject to frequent edits and is expected to grow in scope and detail as program details are developed and decided upon by partner organizations.

The Program Partners section lays out the specific tasks to be performed by the primary partner organizations, specifically Missoula College, Homeward, and the Human Resource Council. Roles of additional, prospective partners are outlined to illustrate what responsibilities are not held by the primary partner organizations and what WRAP requires as outside support. Prospective partner roles are known and defined; the selection of specific entities to fill each prospective role will depend on technical and financial needs identified by the primary partners, and of course, on the explicit agreement of any additional partners found and financial sponsors.

A proposed Program Timeline places each partner’s role in the context of the first-year pilot project. The Timeline has been divided into four successive phases for easy planning by the WRAP Coordinator. The phases do not overlap, and as such they can commence at a pace consistent with partner and WRAP recipient needs.

The Audits and Retrofits section describes what the audits and retrofits may involve. The following brief definitions explain these terms.



- *Audits involve the measurement or other observation of energy use and waste in a home.*
- *Retrofits involve the installation or implementation of an energy-saving device or method.*

The Audits and Retrofits section provides only a simple outline of the proposed measures to be taken because primary WRAP partners have yet to adopt specific audit protocols. Future versions of the Blueprint will include the agreed-upon audit details which, along with available funding, will greatly affect the specific type of retrofits actually done. It is expected that audits and retrofits will be adapted each year to suit the needs of each individual neighborhood. Likewise, the specific details of energy education efforts for participating households will be developed in the future and are also intended to be integral to WRAP.

The Further Considerations and Next Steps section outlines the WRAP designer's recommendations and responsibilities as the future WRAP Coordinator continues to refine the Blueprint. Contact information for all primary partners and contributors to date is listed at the end of this document, along with brief case examples that informed the initial design concepts of WRAP.

## Program Partners

The Missoula Housing WRAP pilot project will involve roughly 20 households in the Franklin to Fort neighborhood in the City of Missoula. This neighborhood was identified by primary partners as a neighborhood in need of energy assistance. The pilot will offer educational materials and workshops, as well as home energy audits, analysis, and retrofits at zero cost to program participants.

Success of WRAP depends on its ability to deliver the above services directly to program recipients. Education is the primary objective of the program and is to be designed and implemented by Homeward. Technical and logistical consultation is to be provided by the Human Resource Council (HRC) and partner contractors. Home energy audits and retrofits are to be performed by students from Missoula College of Technology with assistance from partner contractors.

This pilot will serve as a proof of concept of collaboration among the partner organizations in order to pursue future implementation of the full, annual WRAP program. The following section briefly outlines the role of each partner, primary and prospective, in implementing WRAP.

### A. Human Resource Council (HRC)

HRC provides a diverse array of services to residents in three counties in western Montana. One such service involves using federal grant money to hire contractors to audit and retrofit homes for those who apply and meet the Council's requirements. HRC specializes in retrofitting homes for households whose utility costs-to-income ratios are significantly higher than average. HRC's major role in WRAP is technical consultation in determining target neighborhoods, choosing audit metrics and retrofit methods, and public outreach.



- a. Identify program recipients
- b. Serve as logistical/expert consultants to Missoula College as audits, analysis, and retrofits are performed
- c. Supply resources, such as tools, where applicable for audits and retrofits
- d. Identify and contact contractors recommended for training Missoula College students and overseeing retrofit efforts

## **B. Neighborhood Council**

Missoula's Neighborhood Council provides the most direct line of communication to individual neighborhoods and residents, hosting council meetings and supporting neighborhood projects with financial and technical resources. The Council acts as the umbrella organization, facilitating the actions of individual neighborhood councils in Missoula. The Council's role in WRAP is to facilitate initial outreach to target neighborhoods – in the case of the pilot project, to the Franklin to Fort neighborhood.

- a. Assist WRAP team and Homeward in contacting, meeting with target community and recruiting residents within Franklin to Fort
- b. Serve as liaison between Missoula College team and participants
- c. Assist Missoula College in re-implementing program each year
- d. Potentially provide seed funding (see Program Funding below) for the pilot project via a Neighborhood Grant

## **C. Homeward**

Homeward is a local Missoula non-governmental organization (NGO) that deals primarily with the development of low-income housing and education of residents on issues ranging from home energy efficiency to understanding mortgages. Homeward's role in WRAP is to design and implement the educational aspects of the program by providing educational materials and/or workshops about home energy conservation and efficiency for target households.

- a. Engage target community with forum, meeting, class, or workshop to introduce and teach about home energy savings at beginning of the program
- b. Engage community post-audit/retrofit to provide education about further actions that households can take, ways to gauge energy savings, etc.
- c. Serve as educational and financial consultant for WRAP program
- d. Remain in this role for successive program years

## **D. Missoula College**

The Missoula College trains students in a wide range of trades, including home design and maintenance. Missoula College is part of the Montana University system and is affiliated with the University of Montana in Missoula. Their primary role in WRAP is to train students



enrolled in the spring semester Buildings II class (or other as deemed appropriate by Missoula College faculty and WRAP Coordinator) in home energy audits and retrofits. Students, under the supervision of faculty and home energy contractors, will perform the audits and retrofits as determined by WRAP partners.

- a. Facilitate home energy audit and retrofit education to participating students (with the help of contractor)
- b. Sign audit and retrofit liability agreements with participating households
- c. Perform basic home audits as well as follow-up, in depth audits
- d. Perform home retrofits as per recommendations and audit results
- e. Collaborate with program partners to adapt and re-implement program in yearly cycle

## **E. City of Missoula**

Missoula Mayor John Engen and Conservation Grants Administrator Chase Jones provided the initial guidance for beginning WRAP and have remained interested in the program since its inception.

- a. Endorse program
- b. Publicize and promote program
- c. Assist WRAP Coordinator with identifying funding sources and/or acquiring funds
- d. Advise WRAP Coordinator periodically

## **F. Prospective partners**

- a. Energetechs is an independent home energy company in Missoula specializing in energy audits and retrofits. An Energetechs project manager acting as a private citizen, i.e., operating independent of the company, is currently consulting with WRAP, Homeword, and Missoula College to identify appropriate audit and retrofit metrics and methods. For the Blueprint, Energetechs represents the role of an independent contractor who can assist in training and supervising Missoula College students as they perform audits and retrofits.
- b. A utility or similar entity may be ideally suited to sponsor the WRAP program to claim energy efficiency investment and/or carbon emission reduction and perhaps provide funding. Several such entities are currently following WRAP's development and will be considered by the Coordinator as potential sponsors.
- c. Hardware and garden retail stores in Missoula provide retrofit services and materials as part of continuing company programs to help homeowners perform home energy retrofits on their homes.
- d. The UM FLAT (Forum for Living with Appropriate Technology) is a demonstration house operated by University of Montana students on University property. FLAT residents open their home for a range of sustainable living demonstrations with a particular emphasis on home energy efficiency. The FLAT has offered the use of its



property to Missoula College for training students on energy audit methods as part of Phase I (see Program Timeline below).

## Program Timeline

The WRAP pilot program has been separated into four major phases, with each successive phase building on the results of the preceding phase. Each has a suggested time frame, though strict adherence to these is by no means required for program success. Note that suggested times for phases do not add up to a year: it is not necessary for each phase to come immediately before or after another, as long as all phases are completed in time for the program cycle to begin again.

### *Immediately following formal adoption of the Blueprint by all partners*

1. HRC identifies suitable neighborhood within Franklin to Fort or Northside neighborhoods and provides recommendations for beginning outreach as well as the types of results auditors might expect in that neighborhood given HRC's historical data
2. Budget is itemized and finalized for all phases in the pilot project year
3. WRAP Coordinator secures funding (see Program Funding below) to perform audits and implement education phase based on HRC's recommendations, and to perform retrofits. Funding must cover all upfront and operational costs for the pilot project.
4. Upon confirmation of funding, HRC/Missoula College identifies and contacts appropriate neighborhood council to set up program schedule and scope
5. HRC sends letters to target households to introduce program objectives and design
6. WRAP Coordinator and Homeward sign up interested households and obtain homeowner permission

### *Phase I (Suggested 1 month implementation, does not include planning)*

7. Education and outreach class or workshop held by Homeward
8. Contractor helps train Missoula College students to perform basic home energy audits using UM FLAT (Forum for Living with Appropriate Technology) as test home
9. Basic home energy audits performed by Missoula College Buildings II students (single weekend)
10. Missoula College students analyze audit results, identify inconsistencies between audit and energy bill results
11. In-depth audits performed by students on houses identified as having inconsistencies (single weekend)
12. Students analyze total audit results, prepare list of recommended retrofits to be performed

### *Phase II (Suggested 1 month)*



13. Contractors identified and hired for training of students and supervision of retrofits
14. Retrofit measures and schedule determined by Missoula College and HRC in conjunction with contractors

### ***Phase III (Suggested 2 months)***

15. Contractors train Missoula College students in basic retrofits
16. Contractors and Missoula College students purchase/acquire necessary retrofit supplies
17. Retrofits performed primarily by Missoula College students under supervision of contractors (two or three weekends)
18. Coordinator performs quality assessment (QA) on retrofits (1 month)
19. Initial savings from retrofits reported (1month)

### ***Phase IV (to overlap with the second iteration of Phase I)***

20. QA continues
21. Partner organizations begin cycle again to identify neighborhoods, secure funding, and communicate with neighborhoods and contractor

## Program Budget and Funding

### ***Program Budget***

The budget, as with the funding, is divided into *upfront costs* and *operational costs*. To annually perform the audits and retrofits, some equipment will need to be found or purchased, as described in the *Audits* section below. In addition, the pilot project will require a coordinator (the host organization of the coordinator will need to be reconsidered after the pilot), which may require one-time funding for acquiring a volunteer such as from the Energy Corps. These two categories make up the upfront cost. Actual cost must be determined once the materials list is complete.

Operational costs are those that are repeated each year. In this case, operational costs include the hiring of an outside supervising contractor *or* compensating a supervisor who works in one of the WRAP partner organizations; retrofit labor and materials such as attic insulation, light bulbs, etc.; educational workshops; and other repeating costs. These, also, will be determined once the scope of audits and retrofits has been decided by Missoula College and other partners.

### ***Seed Funding***

In order to effectively audit 10 to 20 houses in the pilot neighborhood, and conduct outreach to recipients in partnership with Homeward, seed funding is required to complement Missoula College's existing resources and training capabilities with additional materials and training and to hire a WRAP Coordinator. Estimates of required



financing have not yet been determined and will require a materials list from Missoula College, a fee estimate from supervising contractors, and a salary estimate for a part-time coordinator position. Seed funding is meant to assist WRAP partners in implementing the pilot program only: further funding should be sought once the program deliverables have been demonstrated.

### ***Retrofit Funding***

In order to effectively retrofit homes of participating households, the material and labor resources of Missoula College will require complementary funding, as will any post-retrofit education programs performed by Homeward. The specific required financing will be dependent on auditing results; however, the proposed budget for the WRAP pilot project should account for expected retrofit measures, as outlined in the following section, Audits and Retrofits. Retrofit funding must be continuing or renewable each year with minimal effort by program partners.

### ***Funding Sources***

The following funding sources and mechanisms have been identified and can be sought after by WRAP partners:

- Sponsorship by utility or other entity in a position to claim energy efficiency investment or carbon emission reduction in addition to favorable publicity through WRAP
- A World Institute for Sustainable Humanity (A W.I.S.H.)
- RESIST (grant of \$4000 or less)
- Montana Energy Corps through the National Center for Appropriate Technology (for Energy Corps Americorps position, which requires matching funds)
- High Stakes Foundation (grant of \$1000 - \$25,000)
- Missoula Neighborhood Block Grant (up to \$3000 annually)
- Missoula Redevelopment Agency (operates large revolving loan fund, focus on low-income housing)
- U.S. Department of Energy (operates annual grant program for energy efficiency programs)
- Long-term integration with University of Montana's Climate Action Plan through carbon offset purchases

## **Audits and Retrofits**

Basic household energy audits involve a largely visual inspection of the house's interior, appliances, fixtures, heating implements, and plumbing. Indoor air quality will also be considered, including the presence of lead-based paint, asbestos, radon, and others. In addition, auditors will use a year's worth of energy bills to determine if any inconsistencies exist between



audit conclusions and the energy usage of the home. Based on this initial assessment, more in-depth audits will be performed using a blower door, smokers and/or infrared cameras, and other equipment to get a more accurate and detailed picture of the home's energy consumption and inefficiencies. The goal is simply to identify the "low-hanging fruit" to improve the home's energy efficiency, which tend to include attic insulation, lighting, programmable thermostats, low-flow water fixtures, plug loads (power drawn by electrical devices), pipe and water heater insulation, and others. Retrofits will be limited to these simpler improvements to avoid contact with dangerous substances, and to reduce funding and time requirements.

Pre-Phase I meetings with HRC audit specialists determined a preliminary list of audit measures, materials, and expected costs. These audit measures represent the best-practices and standard procedures common in audits performed by utility contractors, HRC, and others. Not all typical audit measures are included for reasons of high cost or minimal utility (or both) when considering the retrofit limits described above. This list is expected to change depending on the requirements of the sites and the objectives of Missoula College curriculum.

### *Audit Protocol and Software*

Home energy auditors, in almost any professional capacity, use industry-developed software to record audit data and maintain a database of results and suggested retrofit measures. While each company or utility entity typically has their own software, and relative detail and applicability varies, WRAP auditors (Missoula College students and supervising contractors) will be expected to understand and employ software and protocols. In addition to the education and efficiency benefits, the use of software will allow for easier communication and sharing of audit data with other entities, should WRAP choose to work in conjunction with utilities or others.

There are several free software packages available online; though none so far have fit exactly with the scope of WRAP, the coordinator is encouraged to keep looking for software that WRAP can use with zero or minimal cost.

The most feasible option is likely the use of state software published by the Montana DEQ and used by HRC. While this software is proprietary and requires a fee, Missoula College, being a state entity, may be eligible for the software for free or at a discount. The nature of WRAP as a community-organized effort may make it eligible for free or discounted software from other software providers as well, and this option should be pursued as well.

### *Audit Measures and Descriptions*

- **Basic Blower Door Test:** Blower doors are used to determine the ventilation rate of a home. By sealing off the house (as if for winter) and installing a large fan in one outside door, auditors can pressurize or depressurize a room or building, using gauges to measure the pressure difference between the inside and outside. By measuring the time it takes to pressurize or depressurize a home of a given volume, or the time it takes for the home to reestablish pressure equilibrium with the outside once the fan is turned off, auditors can determine the extent to which air can leak into or out of the home. This is a key part of home audits because it gives a reliable rate at which air can enter or exit the home (ventilation) as well as an estimate of the rate that heat would be gained or lost due to the



movement of air. With some simple calculations auditors can even determine the gross area through which air can travel, a sort of representative “hole” in the home’s envelope.

A standard, modern digital blower door can cost, roughly, between \$1800 and \$3000. Missoula College owns one blower door. If the scale of WRAP is only to include one residential block over two days, or roughly 10 to 20 homes over a weekend, one blower door may be enough to test all participating homes.

- **Combustion Appliance Zone (CAZ) Test:** A CAZ test is used to observe the drafting of combustion appliances in various situations. A home is sealed as if for winter and individual exhaust fans and appliances are turned on to measure pressure and drafting. A Worst Case Scenario uses the smallest BTU appliance in a sealed house with open interior doors (to allow mixing) to test for safety. Built into the CAZ test is the more common flue and combustion appliance drafting test, which simply measures whether combustion appliances are drafting when on. While the CAZ may not be necessary, it may prove useful to Missoula College students training to be auditors. The drafting test, however, is necessary. A combustible gas detector costs \$125.
- **Pressure Pan:** A pressure pan works essentially like a blower door, except that it is used to test the leakage of air ducts (heating, cooling, and ventilation). This sort of test is typically only necessary in homes where ductwork is exposed to unconditioned spaces, or spaces in the home that are not heated or cooled, where insufficient ventilation or high heat loss may be due to leakage of conditioned or fresh air to the environment.

Duct leakage is one of the most common factors in home inefficiency. The WRAP audit specialists for each site will need to determine whether ductwork will even be accessible during the retrofit phase, and decide if a pressure pan test is necessary. A pressure pan can cost around \$80, though a wider range of devices should be researched first.

- **CO Test:** Carbon monoxide (CO) is a product of incomplete combustion, like the burning of charcoal, or the use of a combustion appliance (gas water heaters, for example) with insufficient fresh air. All homes are required to have CO monitors, however these are not always ideally located or even present. A CO test by auditors can determine the optimal location for monitors (and install them if necessary). A portable Monoxor CO monitor costs \$225, while home monitors are \$27 each.
- **Tank and Pipe Insulation:** As hot water pipes and tanks radiate heat fairly efficiently, leading to a greater need for heating within the boiler or hot water heater and therefore higher gas/electric costs, wrapping the pipes and tanks in insulation provides a substantial energy savings for minimal cost. The wrapping material itself is sold in tubes (for pipes) and blankets (for tanks), and cuts down on radiative and convective heat loss.
- **Furnace and Boiler Check:** Due to age or simply their inferior technology, furnaces and boilers can be major sources of inefficiency in the home. Along with exterior insulation (noted above), these appliances should be checked for leakage, drafting, filters, and other performance metrics. Replacement of these appliances, where beneficial, should be considered as part of the WRAP retrofit phase, should funds allow.



- Attic and Crawl Space Insulation: Widely considered the biggest “bang for buck,” insulating unconditioned spaces in the home’s interior should be pursued as one of WRAP’s primary retrofit services. Aside from windows, most home heat loss occurs through the roof and, where a crawl space is present, the floor, both of which are typically only insulated with a wood layer and moisture-resistance material. By blowing cellulose or foam insulation into an attic and installing sheet insulation into crawl spaces, the heat loss of attics and floors can be dramatically reduced.

Blowing attic insulation, which is expected to be necessary in the majority of homes, costs around \$0.82 per square foot of attic footprint (including labor). Foundation insulation, which comes in 4’ x 8’ sheets, costs about \$40 per sheet.

- Lighting and Plug Loads: One of the easiest items to tackle in an audit or retrofit is the power drawn by electrical appliances. While WRAP cannot replace all appliances with more efficient versions, the installation of power strips can help reduce phantom power loss (power drawn by devices that are “off” but still plugged in, like TVs, phone chargers, computers, etc.), and the installation of efficient light bulbs can reduce overall consumption. As plug loads and lighting represent the most direct interaction between residents and their energy usage, this area of the audit and retrofit can also serve as a hands-on education opportunity for residents, who may reduce their energy consumption both through better technology as well as more conscious use of appliances.

As a note, the industry standard for replacing incandescent or halogen light bulbs is to use CFLs (Compact Fluorescent Lightbulbs). While until recently these have been the most cost-effective bulbs from the perspective of the auditor, CFLs generally do not produce light of the desirable color temperature or softness desired by people who are accustomed to sunlight or incandescent bulbs. LEDs (Light-Emitting Diodes), while more expensive to purchase, use less power, last much longer, and provide higher quality light than CFLs. Therefore LEDs, in the interest of providing the best service for program participants and pushing the status quo of energy audits, should be considered in the development of WRAP.

## Further Considerations

### *Liability and Supervision*

- Missoula College performs similar activities in the community and uses their own liability form when working with homeowners. These agreements will be adapted as needed in agreement between HRC and Missoula College.
- Missoula College Students will perform audits under the supervision of professors and staff. Retrofits will be done under the supervision of a contractor by a joint student-contractor team.

### *Communication and Outreach*



- Primary outreach – to be conducted by WRAP Coordinator as the representative of the lead partner and HRC in collaboration with the Neighborhood Council. Recommended outreach combines letters and follow-up phone calls. Framing for Phase I (auditing) must be in terms of the educational component and the potential kickbacks for participants.
- Secondary outreach – follow up letter by HRC

### *Flexibility Mechanism*

- Missoula College and the WRAP Coordinator will address the scheduling & privacy concerns of possible program participants, who must be given enough notice so that WRAP can accommodate one “primary” weekend, then a secondary weekend for those who weren’t available (for each stage).

### *Double- and Triple-Counting*

- Under the Universal System Benefits program, Northwestern Energy (NWE) funds two separate programs to address home energy efficiency: HRC's home audit and retrofit program, as well as NWE's E+ audit and retrofit program, are both funded by NWE (NorthWestern Energy 2013). Any home served by one program cannot be served by the other as such service would be considered redundant from both financial and energy demand reduction standpoints. Additionally, in the hypothetical event that WRAP also utilizes NWE funding, care must be taken to avoid serving homes that have received E+ or HRC's services. The implementation of WRAP without NWE funds would render this issue moot, though double counting could be a concern if UM should help fund WRAP as a local carbon offset endeavor. Note that double-counting between WRAP and HRC alone is not possible as HRC will not be using its financial resources for WRAP purposes.

### *Timing and Commitments*

- WRAP cannot promise program participants what cannot be delivered; thus funding requirements for all phases must be met or expected before outreach to individual households in the designated neighborhood can begin.

## Further Recommendations / Next Steps

### *WRAP Coordinator Position*

Coordination would ideally be done in-house, within one of the three main organizations (Missoula College, HRC, or Homeward). However, the logistical barriers of housing a coordinator or extending an employee’s job description to incorporate coordination of WRAP as a part-time job make the designation of a coordinating organization impossible. Therefore it is necessary to create and fund a coordinator position within a separate entity (thereby allowing the coordinator to apply for funding, etc.).

One recommended option is to provide funding for an Americorps (Energy Corps) volunteer to work either within a separate entity, for example city government or local non-profit. The entity



applying for the volunteer would need to provide about \$11,500, to which WRAP would contribute a proportional percentage for the volunteer to dedicate some time to the development and implementation of the WRAP pilot project.

### ***Short term***

*\*As of August 29, 2014, WRAP is waiting for Missoula College (see John Freer in Contacts section) as they decide which class or academic program is best suited to adopt WRAP into its curriculum. Such decision will inform the scope of the audits and retrofits to be attempted, and therefore the materials list and budget.*

- Deliver blueprint to all partner organizations for review, continue revision.
- Conduct joint meeting between Missoula College, Consultant, and Homeward to discuss audit and retrofit goals, curriculum objectives and scope, and audit protocols used.
- Conduct joint meeting between Missoula College, Homeward, HRC, and Technical Consultant (Energetechs, for example).
- Finalize budget based on audit and retrofit recommendations and Missoula College capabilities.
- A collaborative meeting between representatives of all current partners to formalize commitments. At this meeting, the collective team will need to establish a single point of contact for program recipients, such as the WRAP Coordinator. One of the partners will also need to volunteer to step into a leadership role and serve as the lead organization that also agrees to host and supervise the WRAP Coordinator.
- Apply for funding for WRAP coordinator position and other pilot project funding needs.
- Establish a WRAP coordinator position within the lead partner organizations/institutions.

### ***Long term***

- Conduct 2015 program as a pilot project, implementing all elements of the program for which funding is available in order to prepare for the full, funded run in 2016.
- Turn pilot education, audit, and retrofit events into publicized events with potential Mayor participation
- Consider using some seed money for getting coffee/food truck for education/audit/retrofit “block party”
- Begin larger grant applications to continue and/or expand pilot project (after a successful pilot event in the Franklin to Fort neighborhood, replicability becomes the next priority for Missoula Housing WRAP)
- Explore and develop other financing mechanisms for program longevity such as on-bill financing.



## Contacts (Partners, Prospective Partners, Advisors and Contributors)

### *Primary Partners*

#### Team WRAP

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#### Human Resource Council

Jim Morton, Executive Director - [jpm@hrcxi.org](mailto:jpm@hrcxi.org) (main contact)

Scott Daniels, Audit Specialist – [sad@hrcxi.org](mailto:sad@hrcxi.org) (audits contact)

#### Homeward

Chris Moyles, Energy – [chris@homeward.org](mailto:chris@homeward.org) (technical and main contact)

Andrea Davis, Executive Director – [andrea@homeward.org](mailto:andrea@homeward.org)

#### Neighborhood Council

Jane Kelly, Neighborhood Coordinator - [JKelly@ci.missoula.mt.us](mailto:JKelly@ci.missoula.mt.us)

#### Missoula College

John Freer, Consulting Professor – [john@riverworksinc.com](mailto:john@riverworksinc.com) (main contact)

Dennis Daneke, Assistant Professor and Program Director –

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### *Prospective Partners*

#### Energetechs

Skander Spies, Project Manager – [skander@energetechs.com](mailto:skander@energetechs.com)

#### UM FLAT (Forum for Living with Appropriate Technology)

FLAT manager - [umflat@gmail.com](mailto:umflat@gmail.com)

### *Program Advisors and Contributors*

#### City of Missoula

Office of John Engen, City Mayor - [HBakula@ci.missoula.mt.us](mailto:HBakula@ci.missoula.mt.us)

Chase Jones, Conservation Grants Administrator - [CJones@ci.missoula.mt.us](mailto:CJones@ci.missoula.mt.us)

#### NorthWestern Energy

Deb Young, Regulatory Support – [Deb.Young@NorthWestern.com](mailto:Deb.Young@NorthWestern.com)

### *Other Contacts (recommended as resources)*



MSU Extension Service Weatherization Center (trains HRC on weatherization)

Mike Vogel, Center Head – [mvogel@montana.edu](mailto:mvogel@montana.edu)

Pacific Northwest Center of Excellence for Clean Energy

Barbara Hins-Turner, Executive Director

Phone: (360) 736-9391 ext. 477

(May have knowledge of audit software)

Home Inspection Trainer and Supervisor

Richard Spencer – [hshinspections@msn.com](mailto:hshinspections@msn.com)

(Has experience in low-income weatherization work)



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## Appendix: Case Examples of City Home Energy Retrofit Programs

The following tables summarize three case examples of U.S. cities implementing energy audit and retrofit programs established since 2008.

### **Clean Energy Works Portland – Portland, OR**

A highly collaborative pilot project designed to build a retrofit market through legally binding workforce agreements. Costs and benefits tied to buildings through on-bill financing with utility.

Fund Recycling	Partnerships	Low-Income Targeting	Scale	Implementing Agency
<ol style="list-style-type: none"> <li>1. Capital Funding: \$2 million from CDBG</li> <li>2. Financial Mechanism: Revolving Loan Fund</li> <li>3. Loan Range: \$6500 to \$30000</li> <li>4. Interest Rate 0%; loan repaid when participants sells property with nominal fee</li> </ol>	<ol style="list-style-type: none"> <li>1. City works directly with qualified contractors</li> <li>2. City partners with 3 community organizations for outreach</li> </ol>	<ol style="list-style-type: none"> <li>1. Retrofits limited to homeowners with 80% or less of median annual income</li> <li>2. Contractor incentives to hire local &amp; disadvantaged individuals</li> </ol>	<ol style="list-style-type: none"> <li>1. City wide</li> <li>2. Approximately 300 homes</li> </ol>	<ol style="list-style-type: none"> <li>1. City Community and Development Agency</li> <li>2. Not tied to partners at state, county or regional level</li> </ol>

Source: Brandin, Stitely, and Hoyt (2010)

### **Oakland Weatherization & Energy Retrofit Loan Program – Oakland, CA**

Zero-interest revolving loan fund tied to property sale or transfer. Less of a community collaborative approach, but more targeted to specific demographics.

Fund Recycling	Partnerships	Low-Income Targeting	Scale	Implementing Agency
<ol style="list-style-type: none"> <li>1. Capital Funding: \$2.5 million from ARRA and City</li> <li>2. Financial Mechanism: Revolving Loan Fund with On-Bill Financing</li> <li>3. Loan Range: \$4000 to \$20000</li> <li>4. 20 year amortization period</li> </ol>	<ol style="list-style-type: none"> <li>1. 12 institutions collaborated to design and implement</li> <li>2. 29 partners on the Community Workforce Agreement</li> <li>3. Stakeholder committee to evaluate and implement</li> <li>4. City partners with community organizations for outreach</li> </ol>	<ol style="list-style-type: none"> <li>1. Community Workforce Agreement legally binding contract to higher disadvantaged workers</li> <li>2. Retrofits themselves do not target low-income</li> </ol>	<ol style="list-style-type: none"> <li>1. City, pilot concentrated in single neighborhood</li> <li>2. Approximately 500 homes</li> </ol>	<ol style="list-style-type: none"> <li>1. City Office of Sustainable Development</li> <li>2. Stakeholder board of 29 partners</li> </ol>

Source: Brandin, Stitely, and Hoyt (2010)

# Missoula Housing WRAP



## ***Murray City Housing Retrofit Program – Murray City, OH***

A citywide audit and retrofit program using ARRA funds and utility rebates to fund a block-by-block intensive 14-month program covering 75% of the city’s houses. Used local contractors and community action groups, and was promoted by the city government.

Fund Recycling	Partnerships	Low-Income Targeting	Scale	Implementing Agency
<p><b>1. Capital Funding:</b> Block grant from ARRA</p> <p><b>2. Financial Mechanism:</b> Utility Rebates</p> <p><b>3. Loan Range:</b> Unspecified</p>	<p><b>1.</b> City works directly with qualified contractors and community action agencies</p> <p><b>2.</b> Mayor promoted campaign</p> <p><b>3.</b> Corporation for Ohio Appalachian Development (COAD) coordinated the project</p> <p><b>4.</b> Hocking-Athens-Perry Community Action helped coordinate with COAD</p>	<p><b>1.</b> Low-income households received upgrades at no cost</p>	<p><b>1.</b> Citywide residential community</p>	<p><b>1.</b> Audits performed by COAD</p> <p><b>2.</b> Retrofitting done by community action agencies and contractors</p> <p><b>3.</b> COAD staff performed follow-up quality assurance inspections</p>

Sources: Gerdes (2012, 2013a, 2013b)