Capstone Report

Design of a Building Energy Efficiency Retrofitting Program for Montenegro

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Executive Summary

The Problem

Montenegro has a long-standing history of informal building settlements. The past twenty years in particular have seen a free-for-all construction boom. According to the most recent estimates, up to one third of all buildings in Montenegro are informal — approximately 100,000 buildings in total.

Informal buildings present significant environmental and economic challenges for the country and its people. The government loses tax revenue because the owners of informal buildings do not pay property taxes. Many of these buildings were built with poor construction and waste significant amounts of energy. This wasted energy costs substantial amounts of money to the building owners. High energy consumption also results in higher greenhouse gas emissions, which contribute to climate change.

In Montenegro, informal residential buildings waste the most energy. Additionally, building owners do not invest in maintaining these buildings because they fear the government may demolish them due to their informal status. Owners of residential buildings, in other words, have a disincentive to improve the energy performance of their properties through better insulation and air sealing around windows and doors. In addition, the heating and cooling equipment of these buildings tends to be inefficient.

Wasted energy is expensive for Montenegrin building owners and for the government. Montenegrins spend more on heating and cooling than other European countries. Households in Montenegro spend, on average, €643 per year on energy use, or the equivalent of almost one month's average salary. For the country as a whole, this wasted energy use also means relying heavily on costly fossil fuel imports.

The Opportunity

Montenegro plans to formalize its informal building stock. This planned formalization process presents a unique opportunity to improve the energy efficiency of informal buildings. Building energy efficiency can be improved through energy retrofitting, the process of modifying a building so it consumes less energy. By combining Montenegro's mandatory formalization process with a voluntary building energy retrofitting program, the country has the potential to improve the energy performance of one third of its building stock. As a result, Montenegro will save money and improve its environmental performance.

A retrofitting program generally follows a distinct series of steps. First, the building owner has an energy audit conducted. The audit identifies openings that allow heat to escape and cold air to enter the building. The audit also evaluates the efficiency of the building's lighting and its mechanical systems for heating and cooling. Based

on the audit, a specially trained home improvement contractor develops a retrofitting plan to improve energy efficiency. For example, the audit may indicate that insulation added below the roof would reduce heat loss.

Retrofitting is often expensive initially, but it saves the building owner money in the long-term. The success of building energy retrofitting programs often hinges on the availability of subsidies or low-interest financing that make retrofitting initially more affordable for building owners.

For Montenegro, there are many benefits to implementing a building energy retrofitting program. Such a program would save money for both the government and its residents in the long-term and reduce the country's demand for fossil fuel imports. Improving energy efficiency would also reduce greenhouse gas emissions, which would help Montenegro comply with European Union standards.

The proposed building energy retrofitting program described in this report is designed to retrofit 100,000 buildings in 10 years. Over that time, the estimated program costs to the Montenegrin government amount to €33.6M, or an annual average of €3.4m. The program design, however, accounts for new sources of revenue to fund the program costs.

Our Solution

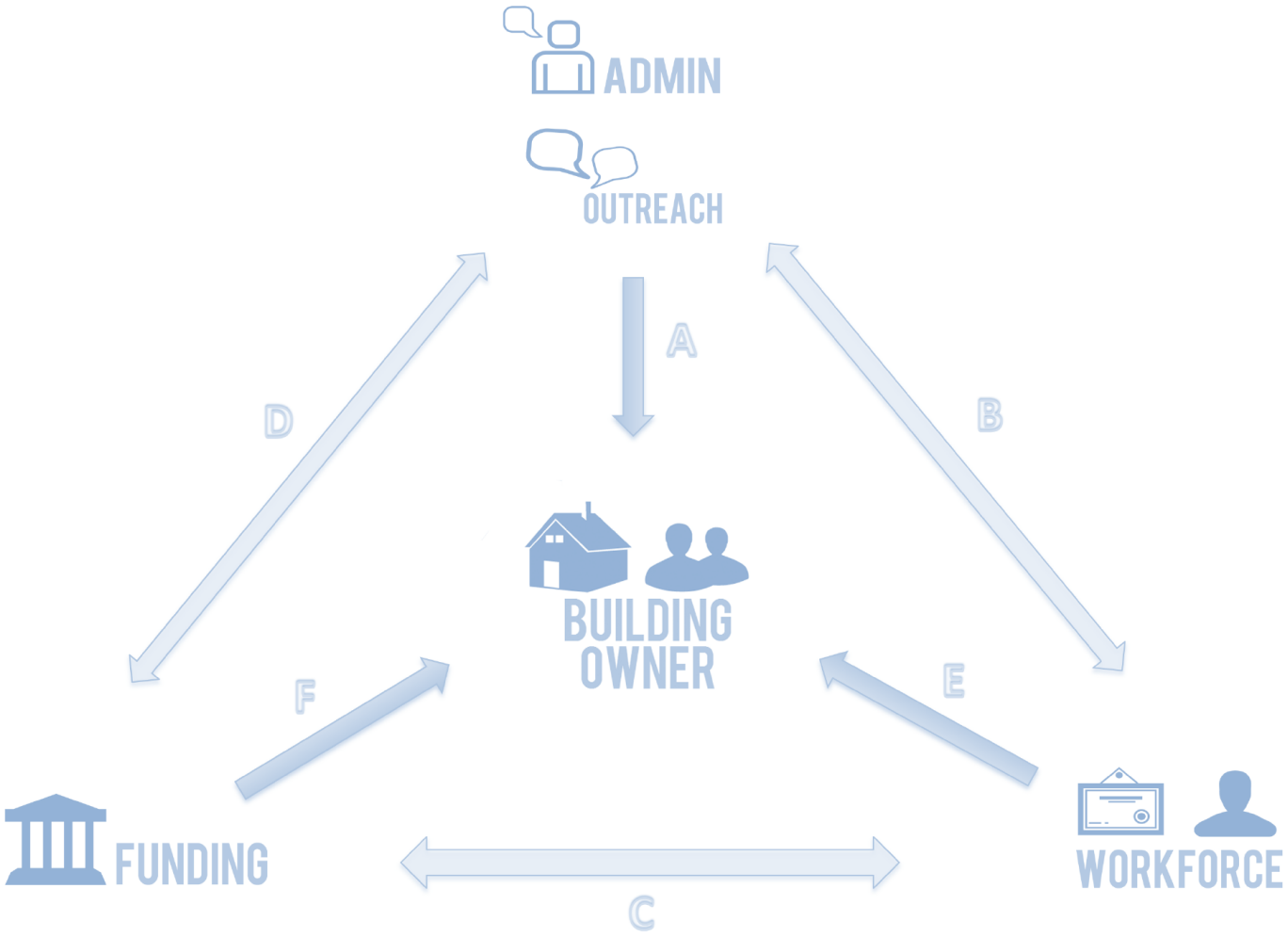
We designed our proposed program with four essential component parts: Program Administration, Public Outreach, Workforce Development, and Funding. The program will be administered via a Central Office that will manage high-level program strategy and oversight, as well as day-to-day operations. An outreach campaign will communicate the benefits of retrofitting to building owners and persuade them to participate in the retrofitting. To do the work, construction workers will be trained in energy retrofitting best practices and certified to participate in the program. Finally, financing options that include low-interest loans and subsidized repayments will be made available to make retrofits affordable.

Methodology

To design the proposed building energy retrofitting program, we benchmarked six energy efficiency programs in the United States and Europe. In the United States, programs included those in Wisconsin, Oregon, Vermont, and the town of Babylon, in New York. We also benchmarked the national programs in Hungary and Germany. We used these programs to identify best practices in building energy retrofitting program design. We adapted the best practices to the political and legal conditions in Montenegro. More information about our benchmarks is included in Appendix I.

Design of a Building Energy Retrofitting Program

Figure 1: Program Component Map



A: The informal building owners find out about the opportunity to retrofit through the program's outreach campaign

B: The administration recruits the retrofitting workforce through outreach and certifies them to do the work

C: The workers are paid by the banks after the retrofit loan is approved by the bank

D: The administration informs banks of a building owner's eligibility for financing

E: The workforce conducts the retrofits

F: Local banks provide the loan for the retrofitting and are paid back by the building owner through the energy savings

Administration

Simplicity and Ease of Use

Recommendation

The administrative structure of the program must be both cost-effective and streamlined. The structure needs to include adequate staff and resources to administer the program. A centralized office allows staff to collaborate efficiently and share ideas and best practices. Additionally, having one central office minimizes overhead costs. Legal requirements of the formalization process restrict a fully centralized administrative structure. Therefore, the proposed administrative structure includes the creation of a high-level and newly-staffed Central Office and the use of existing staff in local offices within each municipality.

Who Does the Work

To keep administrative costs low, each municipality will use already existing staff as Application Coordinators to handle initial application review. The Application Coordinators at each local office will serve as the points of contact for the public. They will provide information about the program to building owners. They will also accept applications to review them for completeness, and ensure that they comply with the formalization process. Once their initial review is complete, the Application Coordinators will submit the applications to their counterparts in the Central Office.

Of the 22 municipalities in Montenegro, 18 contain informal buildings. Each of the 18 municipalities with informal buildings will assign Application Coordinators. The number of Application coordinators will vary based on the number of informal buildings in each municipality. As seen in Figure 3, the majority of informal buildings are concentrated in the municipality of Podgorica. Thus, there will be three Application Coordinators assigned to the municipal office in Podgorica. The remaining 17 municipalities contain fewer informal buildings, and will be assigned one Application Coordinator each. The number of administrative staff proposed for the municipal offices and their responsibilities are outlined in Figure 4.

Recommendations

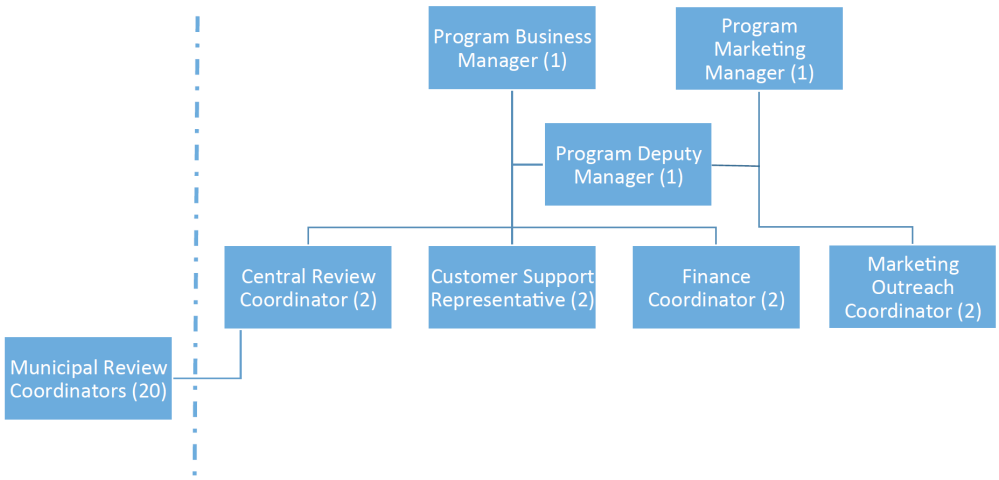
What: New Central administration office, and local offices utilizing existing municipal employees

Who: 11 new full-time administrative staff; 20 municipal representatives in local offices

How: Central Administrative staff oversee higher level strategy and daily tasks; local representatives accept and review applications

Cost: €1.8M over 10 years

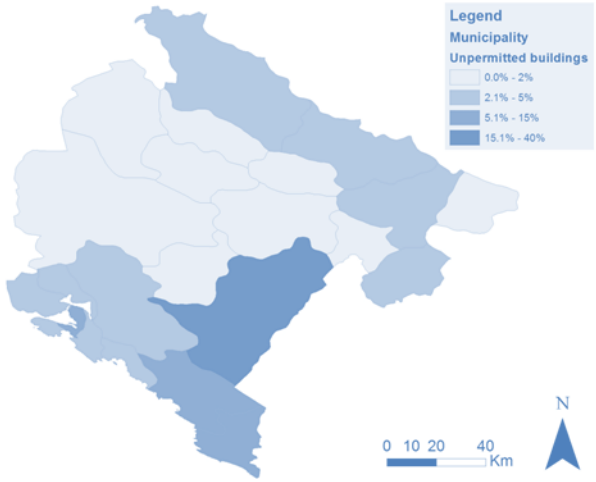
Figure 2: Proposed Administration Structure



How the Work Gets Done

Figure 2 outlines the program's administrative structure and the process map in Figure 7 visually demonstrates how it functions. The building owner can begin the retrofitting process either at a local municipal office or through the website. Using either method the building owner will obtain information about available certified construction workers and will be guided through the application process. The building owner submits his or her energy audit and retrofit application to the Application Coordinator in the municipal office. This can occur in person or through the website. The website will offer information on the entire program, and will allow building owners to participate by submitting applications online. The Application Coordinator checks the application and audit to ensure estimated energy savings greater than 30%. An energy savings of 30% is the minimum amount that will make the retrofit financing affordable to the building owner. This is discussed further in the Funding section of the report.

Figure 3: Informal Buildings by Municipality



After the application is checked, the local Application Coordinators will send the application by email to their Central Application Coordinator counterparts in the Central Office. Here, the Central Application Coordinator evaluates the estimated energy savings based on project standards and approves the retrofit if the

proposed energy savings can be realistically achieved. The Finance Coordinator will then inform the banks of the building owner's eligibility for a low-interest loan. Once approved, the building owner can proceed with the retrofit.

After the retrofitting is complete, the construction company will submit a post-retrofit form to the municipal Application Coordinator in-person or online to confirm the work is completed. The municipal Application Coordinator will create a hard copy final report that will include: the post-retrofit form, the initial application and any supporting documents. This hard copy final report will be sent to the Central Office. At this time, the Central Application Coordinator will confirm project completion and notify the local bank to release the loan payment to the construction company. This process is further described in the Funding section of the report.

How Much the Work Costs

For a staff of eleven in the Central Office, we project an annual budget of €181,200. As outlined in Figure 5, the budget includes: staff expenses for 11 full-time administrators; overhead and office costs for the Central Office; and a consolidated marketing budget. The marketing budget is presented in detail in the Outreach section of the report.

Alternative Options

We considered three different administration models, as outlined in Figure 6. The Centralized Model, combines all of the administration in one single office. For this structure, the Central Office

Figure 4: Central Office Staffing Requirements

Role	Responsibility
Program Business Manager *(1 Position)*	Lead program administration and delivery, coordinate with formalization process and other government agencies on policy directives, and manage program budget.
Program Marketing Manager *(1 Position)*	Lead program marketing strategy, coordinate with stakeholders in press and media, build relationships with key journalists and manage the development of new marketing content like press releases and advertising content.
Program Deputy Manager *(1 Position)*	Support business and marketing manager in day-to-day activities and tasks.
Customer Support Representative *(2 Positions)*	Maintain program website, respond to program participant inquiries via telephone or web portal, and maintain up-to-date list of certified auditors and contractors participating in the program.
Outreach Coordinator *(2 Positions)*	Coordinate with formalization outreach specialists, develop retrofitting specific marketing content, and distribute the content through selected channels.
Finance Coordinator *(2 Positions)*	Work directly with financial institutions to inform on eligibility for funding, and maintain records of individual application loan terms, and coordinate the guarantees for bad loans.
Central Application Coordinator *(2 Positions)*	Provide final approval for the applications and forward the information to finance coordinators

would require 13 full-time staff members. The full-time staff in Figure 2 remains the same, and two additional full-time Application Coordinators are added to the Central Office. This model reduces staff redundancy and streamlines administrative responsibilities. On the other hand, it requires hiring and training all new staff and does not meet the requirements of the formalization law.

In the Decentralized Model, 129 new staff would be required to administer the program from 18 municipal offices. The benefit to this approach is that there will be a local program presence in each municipality, which will create more accessibility for building owners to important staff. However, this is the least cost-effective approach because it creates redundant and unnecessary positions in municipalities with very few or no informal buildings.

We ultimately selected a Hybrid Approach as our recommendation. As Figure 7 demonstrates, the hybrid approach utilizes existing municipal staff already knowledgeable in government functions. This may make the administrative functions more efficient. One potential problem with this model is that the existing staff may be too busy for the additional workload. Regardless, this model is the most cost-effective, while still satisfying the requirements of the formalization law.

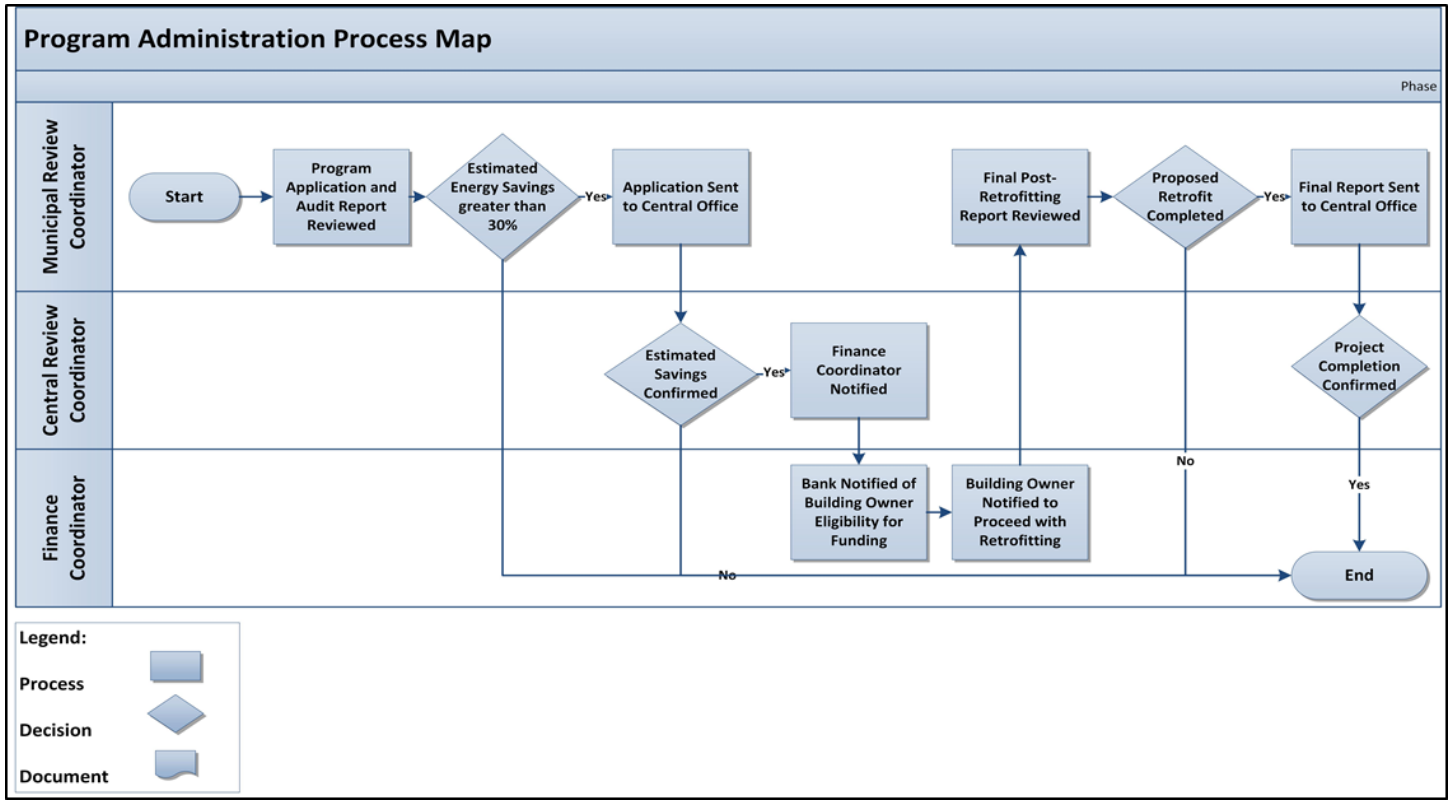
Figure 5: Central Office Staff Budget

Function	Monthly Salary	Annual Salary
Business and Marketing Manager *(2 Positions)*	€1,000	€24,000
Deputy Manager *(1 Position)*	€900	€10,800
Customer Support Representative *(2 Positions)*	€750	€18,000
Marketing Outreach Coordinator *(2 Positions)*	€750	€18,000
Finance Coordinator *(2 Positions)*	€850	€20,400
Application Coordinator *(2 Positions)*	€750	€18,000
Podgorica Office	€2,000	€24,000
Overhead Cost	€750	€9,000
Outreach/ Marketing	N/A	€39,000
Total		**€ 181,200**

Figure 6: Summary of the Three Program Administration Models

Scenario	Annual Costs			
	Staff	Overhead	Outreach	Total
Centralized (13 new positions)	€127,200	€48,000	€39,000	€214,200
De-centralized (129 new positions)	€1,313,400	N/A	€39,000	€1,352,400
Hybrid with municipal staff (11 new positions)	€109,200	€33,000	€39,000	€181,200

Figure 7: Administration Process Map



Outreach

Promote Participation

Recommendation

Because the building energy retrofitting program is voluntary, the program must persuade building owners that retrofits are worth their investment. Building owners must be informed about the opportunity and its benefits through outreach. In the first year, we recommend linking the retrofitting program outreach to the formalization program's advertising campaign. The formalization program's advertising campaign is only budgeted for one year. A single year of advertising will not be sufficient to sustain interest in building energy retrofitting over ten years. It is imperative that residents receive targeted messaging about the societal, environmental, and economic benefits of the retrofitting program each year to ensure continued participation.

Who Does the Work

Within the administration of the Central Office, we have allocated three full-time positions in the Marketing Department. As outlined in Figure 4 of the Administration section these will include one Marketing Manager and two Marketing Outreach Coordinators.

Recommendations

What: 10 year marketing campaign

Who: 3 marketing staff in the Central Office will conduct the outreach work

How: Advertising, informational pamphlets in utility bills, contractor promotion, press relations campaign

Cost: €390,000 for the campaign and €300,000 for the staff for 10 years

How the Work Gets Done

Owners of informal buildings are the primary target audience for the building energy retrofitting communications campaign. The campaign's key message should focus on persuading informal building owners to retrofit their homes. Simply put, retrofitting their homes will save them money, increase the comfort of their home, and increase their property value.

The outreach campaign messages should also target owners of formal buildings. These building owners will not be eligible for the retrofitting program at this time. However, the funding for the retrofitting program will require the use of public resources. As detailed later in the Funding section of the report, we recommend including a utility surcharge on all electricity bills. For this reason, it is critical to ensure nationwide support of the program. For owners of formal buildings, messages should focus on the societal benefits of the retrofitting program. The program will create

Figure 8: Outreach Campaign Messaging

Owner of Formal Building	Owner of Informal Building	All Citizens
• May lead to a national building retrofit program • Reduced energy demand may stabilize energy prices	• Reduces cost of energy • Better indoor comfort • Increased property value • Increased aesthetic value	• Increased energy security and independence • Reduced climate change risk • National pride • Creates local jobs

jobs and increase economic development. Reducing energy use will reduce demand for energy imports, which may stabilize energy prices. Lowering energy use will also reduce the country's greenhouse gas emissions and reduce its contribution to climate change. For an overview of messaging by target audience, see Figure 8.

The retrofitting program should be included in the advertisements for formalization. However, this will be a brief six to twelve month campaign. For the next nine years, program messaging should be promoted through four key delivery methods. The campaign should feature television and radio advertisements, informational pamphlets in utility bills, construction worker promotion, and press outreach.

Advertising

A paid advertising campaign should promote messages about the benefits of retrofitting. Advertising funds should be targeted at television and radio ads, which are the most cost-effective. The formalization program's marketing campaign purchases 10 television ads and 5 radio ads that run for an entire month, twice a year. Using the formalization marketing strategy as a precedent, we recommend a similar rollout of 15 ads for one month, twice a year.

Informational Pamphlets in Utility Bills

Informational fliers about the program should be produced by the marketing team and distributed in electricity bills. All building owners will receive these fliers. The fliers will both explain the utility surcharge and promote the benefits of the retrofitting program. The informational pamphlets should be distributed one month per year to reach all building owners.

Figure 9: Outreach Budget

Budget	Annual budget
Staff (3 FTE)	€30,000
TV and radio campaign	€20,000
Utility bill insert (€0.05 each)	€15,000
Creative consultants (€50/hour)	€4,000
Total	€69,000

Construction Worker Promotion

As part of the certification training, construction workers should be taught key messaging to promote the program. The training should outline key messages for the construction workers to deliver to their customers who have not yet retrofitted their buildings. The construction workers will also be given informational material to distribute. The informational material will have the same design as the utility bill insert.

Press Relations Campaign

The focus of the press strategy should be to build relationships with journalists to garner free publicity for the retrofitting program. The outreach team should create press releases, short videos, and blog posts with updates about the program for the press. This should be a consistent effort highlighting important successes as they happen. The goal of this campaign is to raise awareness about the benefits of energy retrofits.

Delivery Timeline

The messages delivered through the outreach strategy should evolve based on the changing needs of the program. The evolution should occur in three stages: The first stage will aim to raise awareness of the goals of the retrofitting program in general. As outlined later in the Workforce section, we anticipate that the number of retrofits will increase over time with a peak in Year 7. As participation builds, the second stage of outreach should shift messaging from maximizing awareness to maximizing participation. In the third stage, the program outreach should attempt to persuade the remaining owners of informal buildings to retrofit their homes by highlighting prior successes of the program to date.

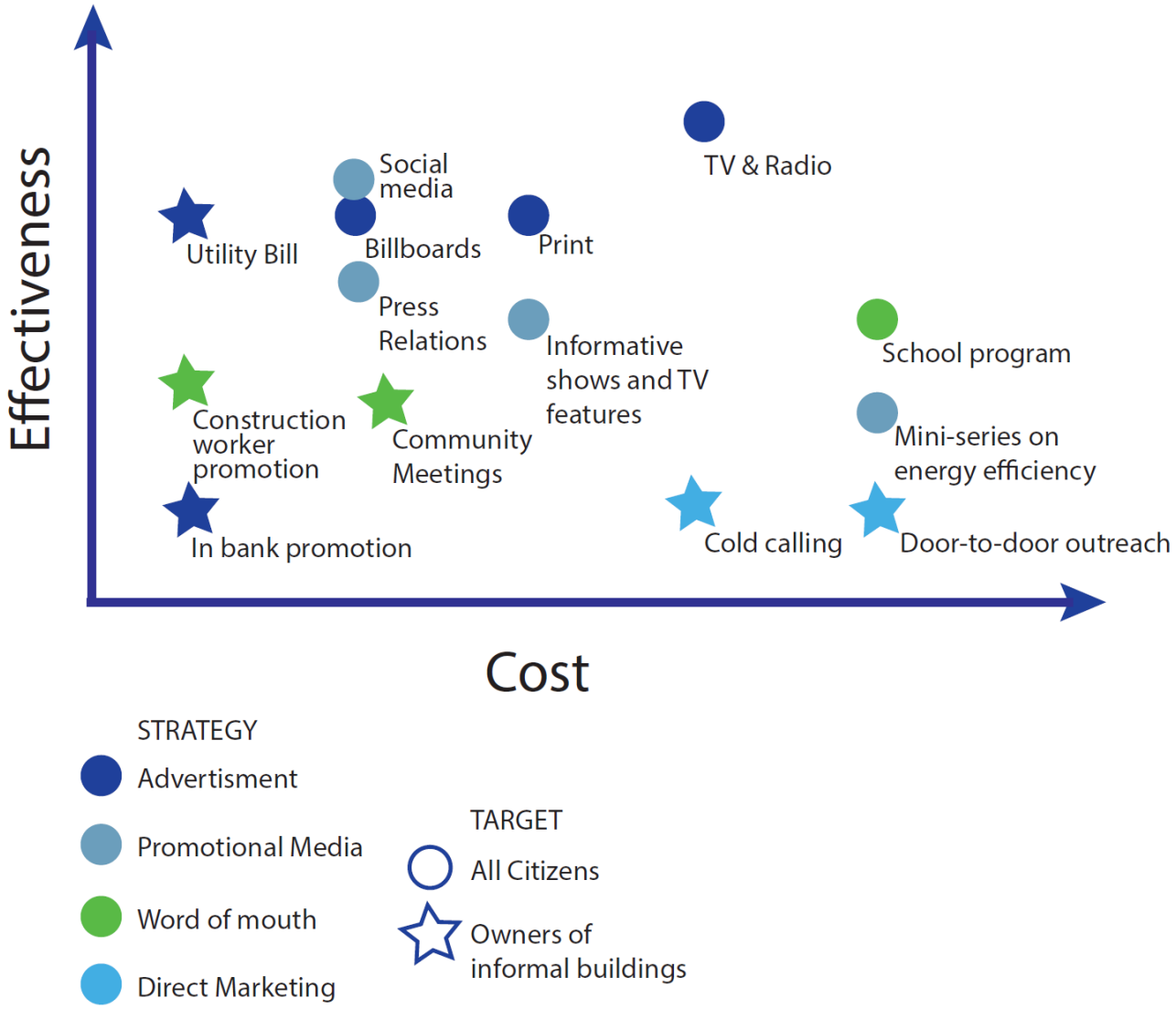
How Much the Work Costs

The marketing budget is €69,000 and is accounted for in the administrative budget. In the marketing budget, €30,000 is allocated to three full-time administrative staff. The remaining €39,000 is allocated to the production and placement of paid advertising, materials and printing for utility bill inserts, and creative consultants to design marketing materials. On an annual basis, creative consultants will be hired to create higher-level design concepts. For an overview, see Figure 9.

Alternative Options

We analyzed a variety of communication strategies, including those from benchmarked programs, the Montenegrin formalization program, and Deutsche Gesellschaft für Internationale Zusammernarbeit (GIZ). Figure 10 is a summary of these strategies based on their cost and efficacy.

Figure 10: Summary of Communication Strategies



Workforce

Train the Workers to Do the Job Right

Recommendation

The government should partner with the University of Montenegro to train and certify construction workers. Building energy retrofitting requires specialized knowledge and skills to reduce energy use. Workers must be able to apply these skills to conduct high-quality construction work to reduce building energy use. The success of the program hinges on these energy savings. The University has conducted similar trainings before and should lead the development of the training curriculum. There are currently enough construction workers in Montenegro to be certified in building energy retrofitting. To participate in the program, construction companies must ensure that each retrofit is led by a certified construction worker.

Recommendations

What: Mandatory certification and training program for construction workers

Who: A minimum of 340 construction workers will need to be trained and certified

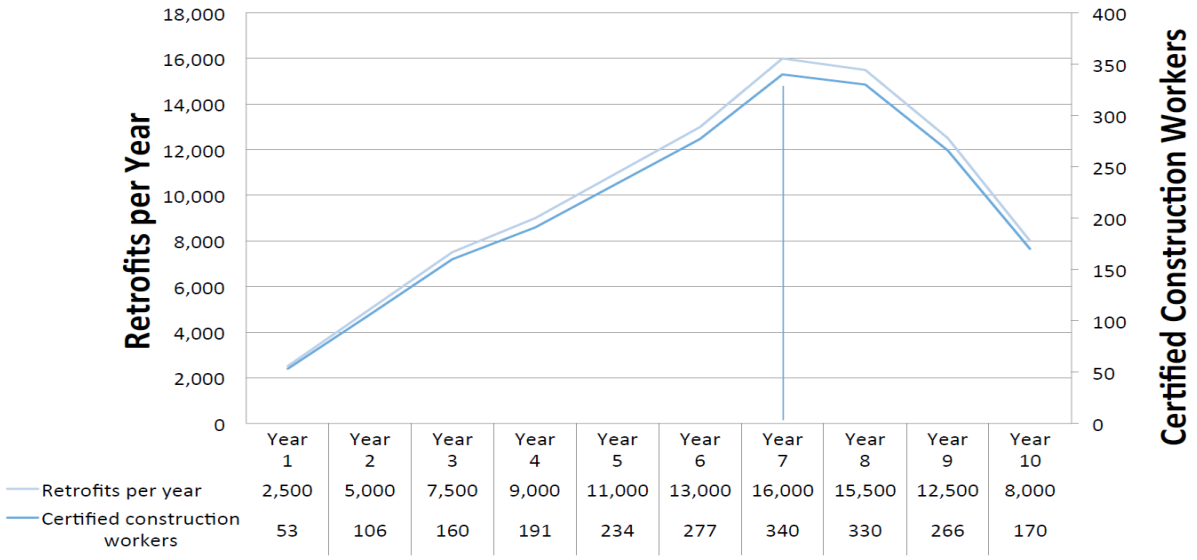
How: Partner with the University of Montenegro to create a training curriculum

Cost: Training will cost construction workers €300 plus €50 for certification exam

Who Does the Work

We recommend that the program train and certify 340 construction workers. This will meet the demand for certified construction workers at the anticipated program's peak. It will take time to

Figure 11: Retrofit Intensity



	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Retrofits per year	2,500	5,000	7,500	9,000	11,000	13,000	16,000	15,500	12,500	8,000
Certified construction workers	53	106	160	191	234	277	340	330	266	170

engage building owners. Our analysis assumes that the annual number of retrofits will increase as the program develops and, as seen in Figure 11, the highest number of retrofits occurs in Year 7.

Our benchmarks show that a building retrofit project takes, on average, 100 work hours to complete. The number of workers in a construction crew will vary. However, we estimate an average of three workers per crew. One hundred work hours allocated among three workers equates to 33 hours per worker. Using these estimates each retrofit will take approximately one work-week.

Factoring in holidays and other time off, each certified worker will work 47 weeks of the year. Since each retrofit requires a certified worker, there will need to be as many certified workers as concurrent retrofits. Based on our timeline, which suggests a peak in Year 7, there will need to be approximately 340.

How Training and Certification is Achieved

Certification and Training Program Structure

In 2008, with the support of GIZ, the University of Montenegro ran a successful energy auditor training program. Therefore, we recommend that the University of Montenegro develop the building energy retrofitting training curriculum in partnership with the retrofitting program administration.

The University will coordinate and conduct the training program after the curriculum is developed.

Upon completion of the training, participants can register for the certification exam to be administered at a testing center. Once the participant passes the certification exam, they are now qualified to lead a retrofitting construction crew.

The program administration will maintain a list of construction companies with certified workers on staff. It is the responsibility of the construction companies to notify the program administration of the certified workers that they employ. This ensures that they are included on the list and can participate in the program.

All of the details of the construction worker certification program are displayed in the process map in Figure 12. It also outlines the key staff and organizations involved in the process.

Curriculum

Subjects	Topics
Key Concepts:	Building Science and Energy Efficiency Fundamentals
Strategy:	Energy Reduction Strategies
Process:	Diagnostic Testing and Data Analysis
Methods:	Retrofit Work Best Practices
Communication:	Work Practices, Reporting Requirements and Promotions

Training Curriculum

In order to achieve the high energy savings desired, a comprehensive training program is required. We advise modeling the curriculum closely to the Building Performance Institute's (BPI) training program in the United States. The BPI program is consistently used as the standard best practice certification program in the United States. More than 50 energy retrofit programs use BPI certification credentials as a prerequisite for their program's energy efficiency contractors. Based on the Building Performance Institute's program, we recommend that, at minimum, the curriculum include the components outlined in the curriculum inset.

How Much the Work Costs

Much of the framework for the training already exists from the previous auditor training program and BPI. We have estimated it will take approximately two to three months, or 60 working days, for an individual at the University to adapt the curriculum for Montenegrin workers. According to the UNDP, Montenegro professors charge €250 per day. At this rate, development of the training program would cost the University approximately €15,000.

Our estimate for the cost of tuition for the training program is based on the rates for equivalent BPI training in the United States. In Montenegro, the tuition costs will be approximately €300 per construction worker. This cost covers training supplies, including manuals, as well as costs associated with classroom and field training. The contractor is responsible for paying the costs of the training. An additional €50 would need to be paid by the contractors to a testing center for the certification exam.

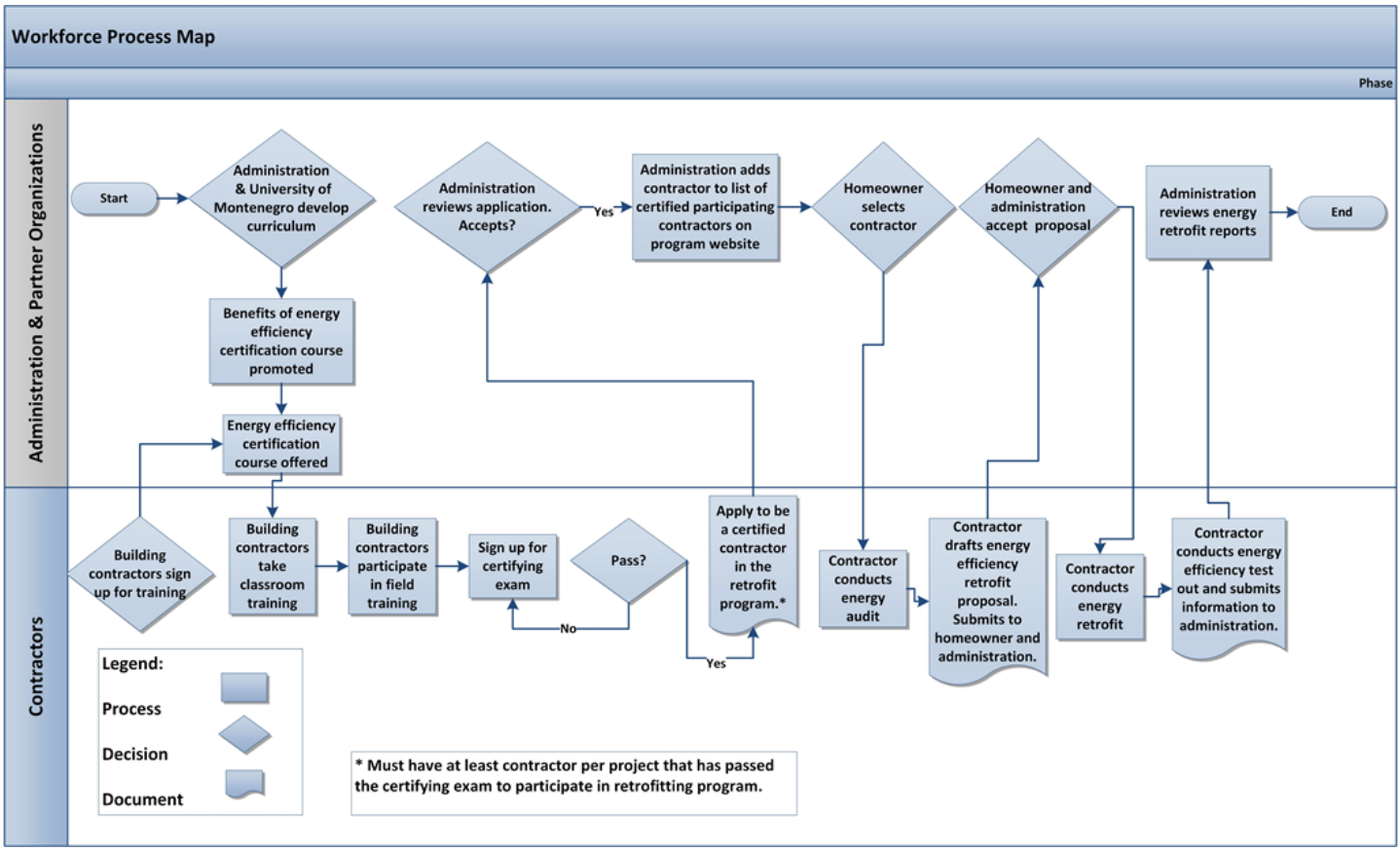
We estimate that the training will take five days for a construction worker to complete with an average class size of 15. A portion of the tuition fee (estimated to be €50) will go towards covering manuals and equipment. The costs for a University of Montenegro professor to run the training would be €1,250 for a five-day training. Therefore the net profit to the University for each class of 15 would be €2,500.

Alternative Options

To ensure that certified workers maintain the highest level of expertise, the government could require periodic certification renewal. This can be achieved either through testing similar to the certification exam, or continuing education opportunities. Continuing education opportunities could include classroom teaching, seminars, or online courses. A continued partnership with the University of Montenegro could be used to identify and develop these opportunities.

As a way of verifying quality retrofits have been performed, random post-retrofit audits could be performed by third-party auditors. This would ensure that construction companies participating in the program are performing quality work, and promised energy savings are achieved.

Figure 12: Workforce Process Map



Funding

Retrofitting Must Save People Money

Recommendation

The retrofitting program must be designed to save building owners money. There are several financial barriers common to building energy retrofitting programs. These barriers can prevent building owners from participating. First, building retrofits require upfront capital financing, but not all building owners have access to it. Second, if a loan is acquired to pay for these upfront cost, energy savings alone do not always cover the monthly loan repayments. Both low-interest loans and government-subsidized repayments are common to successful energy retrofitting programs. To ensure participation, we recommend offering a combination of both of these incentives.

Who Does the Work

A system must be put in place to distribute funding to building owners to pay for the retrofits. The system will involve partnering with the European Reconstruction and Development Bank (ERDB), who has agreed to provide initial funding to the government. In addition, local Montenegrin banks will work with the government and building owners to package and distribute loans. Two full-time positions in the program's administration will coordinate the funding process between the building owners, the local banks and the government. Figure 13 outlines the parties involved in the funding process and how they work together.

Recommendations

What: Affordable financing for building owners to make retrofitting affordable

Who: Partner with ERDB for initial capital for loans; work with local banks to distribute loans

How: Low interest loans made available to building owners with subsidized loan repayments

Cost: Subsidies of €31.8M over 10 years

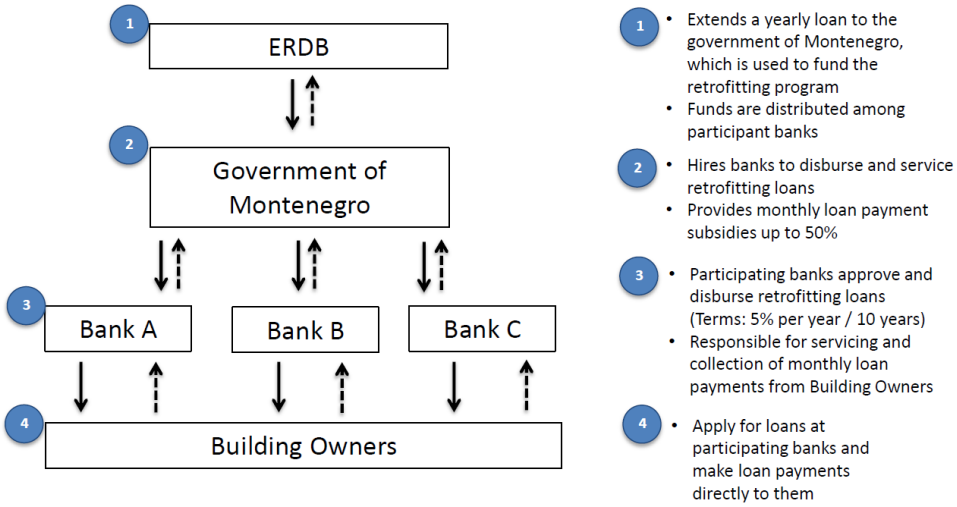
How the Work Gets Done

We recommend that retrofits be funded through a combination of low-interest loans and repayment subsidies, as shown in Figure 14. Our calculations assume low-interest loan availability for the duration of the program.

Low-Interest Loans for Building Owners

Low-interest loans are offered to the building owner at a 5% interest rate. The total loan amount should be up to the cost of each retrofit, which is estimated to average €5,000 per building. Building owners will begin by submitting an application. After the application review is completed, building owners will select a certified construction company to conduct an energy audit.

Figure 13: Program Money Flows



The audit will include an estimate of retrofitting costs. If the Central Office approves this estimate, the finance coordinator then contacts the bank to notify them of the building owner's loan eligibility. The building owner will finalize the terms of the loan directly with the bank. Once finalized, the bank will disburse the payment directly to the construction company. Finally, loan repayments will be made directly from the building owner to the bank.

The loan-lending system is outlined in Figure 13. The initial funding for loans will originate with the ERDB. The ERDB directs the funds to the government of Montenegro. Next, the government of Montenegro will distribute the funds to local banks, who will then package the loans for building owners. After the retrofit is complete, building owners will repay the cost of the loan directly to local banks. Local banks will then repay the government of Montenegro, who will in turn repay the ERDB. According to information provided by the UNDP, initial funding from ERDB is being given at a yearly interest rate less than 5% and a 10 year repayment term.

Subsidies on Loan Repayments

In addition to low-interest loans, we recommend a 50% subsidy on monthly loan repayments to make the retrofitting program affordable for building owners. In other words, the building owner and

Figure 14: Retrofit Incentive Funding

Total Program Cost	Retrofit Incentives	Sources of Program Funding
€33.6M	Loan-Interest Loans (10 yrs, 5 %) Loan Repayment Subsidies (50%)	Property Taxes (20%) Formalization Fee (20%) New Income Tax Revenue Utility Surcharge (0.5%)

the government of Montenegro will split the cost of the retrofits. As outlined in Figure 15, without this financial incentive, retrofit costs will be greater than energy savings. Because the retrofitting program is voluntary, if costs are greater than savings, program participation will be low. Offering subsidies for voluntary retrofitting programs is considered a best practice. Our benchmarking analysis shows that subsidies are widely used among public energy retrofitting programs. In the United States, programs in Vermont and Wisconsin both offer rebates and other incentives. In Germany, the development Bank Kreditanstalt für Wiederaufbau (KfW) offers low interest loans and additional incentives for achieved energy savings.

Figure 15 depicts the three bill scenarios discussed above: pre-retrofit, post-retrofit with no subsidies and post-retrofit with subsidies. The calculation of the subsidies is based on an average home size of 100 m^2 with a monthly energy bill of €100, €5,000 retrofitting costs and average 30% energy savings after the retrofit. Changes in these different components, for example monthly energy bills, retrofitting costs and average energy savings after the retrofit, will impact the required subsidy amount.

To calculate the amount of money the government needs to provide in subsidies, we estimated total monthly costs for the building owner both before and after the retrofit. Based on information provided from the UNDP, the current average monthly energy cost for Montenegrins is €100, which includes electricity and wood-fired heating costs. We estimate a 30% energy savings after the retrofit is complete, thus reducing energy costs to €70 per month. However, if a loan is taken for a retrofit, building owners must now make monthly loan repayments in addition to the energy bill. Monthly loan repayments for the building owner will cost €53 without a subsidy. This brings the total monthly payments for the building owner to €123 (€70 + €53 = €123). This is more than the €100 monthly energy payment before the retrofit. With the recommended 50% loan subsidy, the monthly total payment will be reduced to €97 (€70 + €27 = €97). By providing the loan subsidy,

Figure 15: Monthly Loan Repayments, with and without Subsidies

	Without Subsidies	With Subsidies (50% of monthly loan payments)
Starting Monthly Energy Bill	€100	€100
Post-Retrofit Energy Bill (with 30% energy savings)	€70	€70
Monthly Loan Payments (Principal and 5% interest, on €5000 retrofit, paid over 10 years)	€53	€27
Actual Cost to Building Owner	€123	€97
Net Total Change	€23	(€3)

the government will encourage voluntary participation as the subsidy will remove the financial burden and guarantee savings for the building owner.

Our estimation of 30% energy savings is based on a combination of data from two major sources. Data from an energy efficiency pilot program in Montenegro produced an average of 63% energy savings from 30 retrofits. However, data from the American Council for an Energy-Efficient Economy shows lower energy savings of only 12-17% on average based on all retrofitting programs in the United States. Because of this drastically lower estimate, we maintain a more conservative estimate of 30% energy savings to ensure that the financing of the program is sufficient.

How Much the Work Costs

We project that the complete retrofitting program will cost the government €33.6M over 10 years. As outlined in Figure 16, the program costs cover both the administrative costs and the loan repayment subsidies.

Source of Funding for Total Program Costs

We recommend that the retrofitting program be funded through four sources: property taxes, formalization fees, a utility surcharge, and a

Figure 16: Total Project Cost for Montenegro

Costs	Total (10 years)
Loan Subsidies (50% of Monthly Loan Repayment)	€31,819,654
Administrative Costs	€1,812,000
Total Project Cost	€33,631,654

Figure 17: New Funding Sources for Project Costs

New Funding Source	Total (10 years)
Property Tax (20% of total collected)	€8,000,000
Formalization Fee (20% of total collected)	€5,000,000
Utility Surcharge (0.5% of total collected)	€8,103,730
Income Tax from New Employment	€12,527,924
Total New Government Income	€33,631,654

Non-Performing Loans

In addition to these costs, the government will need to account for possible loan defaults. Currently the non-performing loan (NPL) ratio in Montenegro is approximately 19%. To account for this, the government should budget for an additional contingency funding of €9.5M annually.

combination of value added income taxes. See Figure 17.

Property Taxes and Formalization Fee

For newly formalized buildings, we propose that 20% of the formalization fee and 20% of the property tax are a reasonable amount to be allocated to the retrofitting program. Within one year, 100,000 building owners will begin paying a formalization fee and annual property taxes. This is new revenue for the government. Twenty percent of each of these new revenue sources will generate an average of €13M over 10 years to the retrofitting program. We based this projection on an estimated average of €250 per building per year for the formalization fee and €400 per building per year in property tax.

Utility Surcharge

We recommend adding an energy efficiency utility surcharge to every customer's electricity bill. The surcharge will equal 0.5% of the customer's bill amount and is expected to be very small for the individual bill payer. However, the total collected amount of the surcharge is estimated at over €8.1M. Initially, the surcharge will be applied to the cost of the retrofitting program. Over time, the surcharge can be used to fund other energy efficiency projects for the country. Montenegro currently has a National Action Plan for Energy Efficiency Measures in the Residential Sector. As such, the surcharge can be applied to all Montenegrins because the funds from the surcharge will benefit the entire country.

Income Tax and Value-Added Tax

The retrofitting program will generate additional revenue from income tax through new jobs, and value-added tax from construction materials purchases. We estimate that a total of €81M in additional tax revenue could be generated from 100,000 retrofits over 10 years when income tax and value-added tax are combined. We recommend allocating a total of €12.5M (15.5%) of this to the retrofitting program's budget.

Our estimate of €81M combines income tax revenue of €28.5M and value-added tax revenue of €52.5M, as outlined in Figure 17. Income tax in Montenegro is 15%, and we estimate that 70% of retrofit costs will be spent on labor. The remaining

Benefits of a Utility Surcharge

Funding from the utility surcharge contributes to the success of the building energy retrofitting program which will benefit owners of formal and informal buildings by improving country infrastructure and increasing overall property values.

Channeling funds towards energy efficiency will reduce the country's energy demand, thereby reducing the need to import fuel from other countries and increasing energy security and energy independence.

Investing in energy efficiency will reduce Montenegro's greenhouse gas emissions, putting the country on par with other European Union countries, and facilitating assimilation to the European Union.

30% of a retrofit's costs are attributed to materials, on which there is a 19% value-added tax. Our calculations are based on a €5,000 total average retrofitting cost per home.

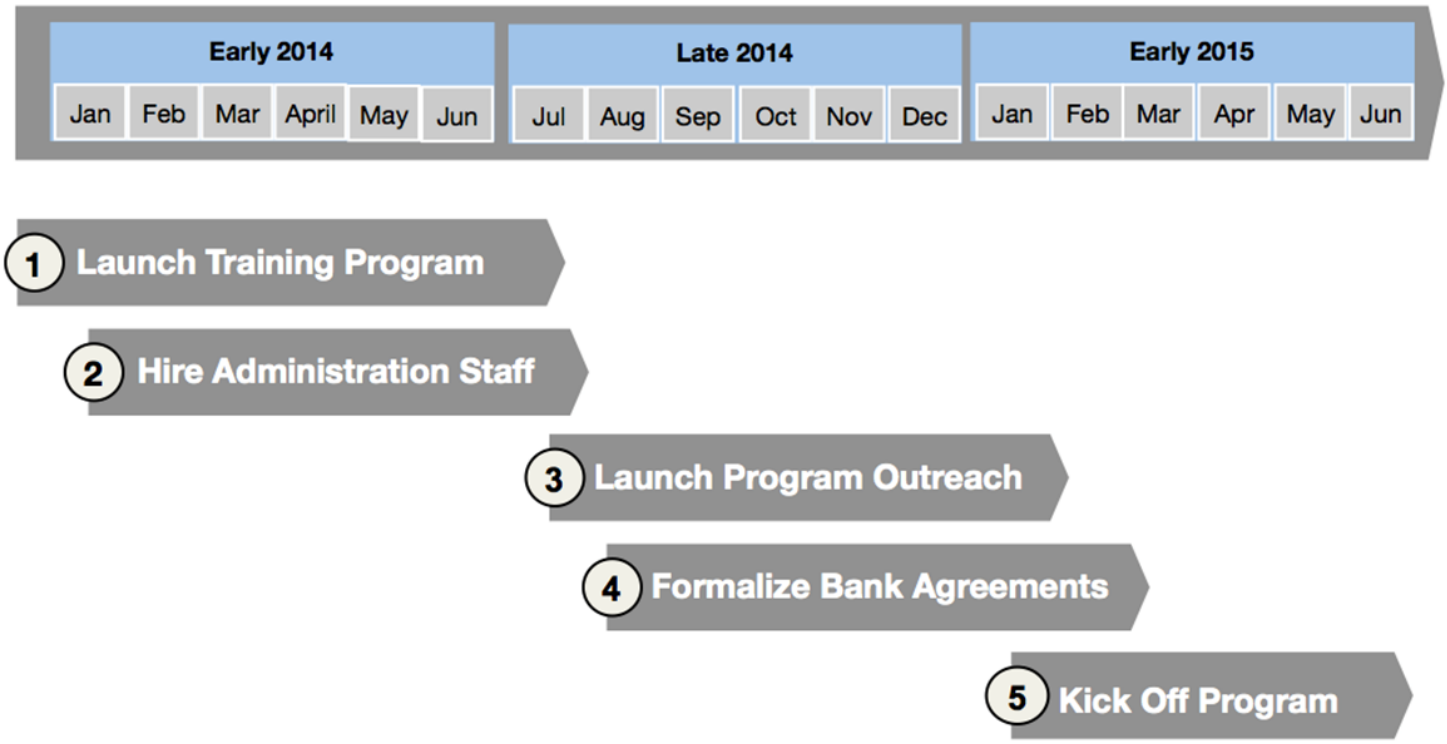
Additional Options

As an alternative for building owners, loan repayments could be consolidated into the monthly utility bill. In this case, the building owners would repay their monthly loan amount as an addition to their monthly utility bill instead of as a separate loan statement from the bank. The advantage of this repayment structure is that energy savings and the monthly payment are both shown on the same statement. This makes it easy for the building owners to compare investments and savings. Also, this repayment structure will minimize the loan default rate. If the bill is not paid, the utility company can disconnect service. The disadvantage is that the utility company will bear the administrative burden of this repayment system. Therefore, in order to keep administration costs lower and ensure effective implementation, we recommend keeping the repayments with the bank.

Program Implementation

When the Work Will Be Done

To implement the proposed program, we recommend that the University launch the training program in early 2014, and the government of Montenegro hire administrative staff. Later in the year, program outreach should begin and agreements should be formalized with banks. The program can be ready to kick off in 2015.



Conclusion

Benefits of an Building Retrofitting Program

The building energy retrofitting is a strategic choice for Montenegro. Retrofitting informal buildings will save both building owners and the government of Montenegro money. Energy retrofits will create jobs, generate tax revenue, and lower energy demand. If successful, the building energy retrofitting program has the potential to create a framework for a national energy retrofitting program. A national program will benefit all building owners and provide environmental and economic benefits to the country.

Benefits of Energy Efficiency

Economic Development

The building energy retrofitting program will create new skilled jobs. These new jobs benefit the economy by lowering unemployment and increasing government revenue through two taxes: income tax and value added tax. According to the Statistical Office of Montenegro, unemployment in the construction sector was 19.2% in the second quarter of 2013. Based on our calculations, the retrofitting program has the potential to add 577 construction jobs, which would result in a 0.2% drop in the unemployment rate .

There is also an opportunity for significant tax revenue. As previously discussed, an estimated €81m in additional tax revenue could be created from 100,000 retrofits with income tax and value -added tax combined. After allocating €12.5m to the building energy retrofitting program, €68.5m in new revenue still remains for the government.

Lowering Energy Demand

Montenegro currently meets more than two-thirds of its energy demand with fossil fuel imports such as petroleum and coal. Montenegro's dependence on petroleum and coal imports increases its economic vulnerability to energy supply disruptions, and price increases. By lowering demand, Montenegro will improve its energy independence. Additionally, the country will be less affected by rising fossil fuel prices.

On average, the current energy consumption of informal buildings equates to approximately 108,000 tons of carbon dioxide equivalent, a measure of greenhouse gas emissions. Once all retrofits are complete, we estimate that greenhouse gas emissions could be reduced by 40,000 – 80,000 tons of carbon dioxide equivalent each year.

Wisconsin Focus on Energy

For the Wisconsin program, homeowners initially sign up for an energy assessment, a portion of which is paid for based on income level. They then schedule an audit with a Trade Ally from the program's website. The Trade Ally performs a home energy assessment, and upon completion provides the homeowner with a Home Energy Assessment Report. Together they decide on which home improvements to make. After the Trade Ally makes the agreed upon improvements, the homeowner receives an instant rebate on their invoice of up to $2500. A post-assessment test is done with the Trade Ally to confirm proper installation of the improvements.

Administration

- Administered be 3rd-party group, CB&I
- CB&I is responsible for design of programs and overall performance towards meeting energy savings goals
- Day-to-day responsibilities include: contract management, coordination of individual program offerings, customer and Trade Ally support, coordinating with participating utilities, marketing and communications, and reporting to the Statewide Energy Efficiency and Renewables Administration
- CB&I has 32 full time equivalents working on program administration

Funding

- Funded by state's investor-owned energy utilities via monthly on-bill surcharge of 1.2%

Workforce

- Contractors approved by administrating body CB&I
- Approved contractors become part of the Trade Ally program
- More than 1600 Trade Allies perform retrofits
- Periodic training and reviews conducted by CB&I

Long Island Green Homes

Participants in the Long Island Green Homes Program initially submit one year's utility data for their home and a Home Inventory Checklist via the program's website. A free audit is then scheduled and performed by a Town-licensed, Building Performance Institute certified energy auditor. A detailed report with recommended solutions, including costs and estimated savings is provided to the homeowner. A work contract is then drawn up and approved by the program administration team. All upfront costs are paid directly to the contractor by the Town, and a separate contract is drawn up with the homeowner for monthly on-bill repayments.

Administration

- Administering body is Town of Babylon, currently four staff members
- Staff responsible for advertising, business development, website registration process, scheduling contractors, reviewing contractor proposals for retrofits, approving and drawing up contracts, paying contractors, and acting as billing agents for homeowners

Funding

- Funding for retrofits comes from the Town's Solid Waste Reserve Fund
- Continues as a self-financing, revolving loan fund that does not rely on any government grants or new taxes
- 3% interest rate applied to all loans are used to cover administrative costs associated with the program
- Maximum funding available to each homeowner is $15,000
- Various other state or utility provided rebates help pad funding
- Failure of homeowner to repay results in that amount being added to the property taxes in subsequent years

Workforce

- Town of Babylon maintains a list of around 30 contractors who have been licensed by the Town and trained by the Building Performance Institute (BPI)
- Contractors and auditors are typically one and the same
- Minimum qualifications for contractors to be licensed by the Town are Building Analyst and Envelope Professional credentials
- One-week trainings for these certification tests are provided for $2500
- Credentials must be renewed every two years

Clean Energy Works Oregon

Homeowners participate in the Clean Energy Works Oregon (CEWO) program by submitting an application online. A Home Energy Assessment is scheduled by CEWO program staff once the application is reviewed. A Building Performance Institute certified energy advisor, employed by the program, guides the homeowner through the retrofit process. A program-approved contractor then conducts a Home Energy Assessment and submits the Home Energy Assessment Report to the homeowner and the energy advisor. The energy advisor reviews the proposal against program benchmarks, and if accepted, works with the homeowner to identify instant rebates and submit loan applications with selected lenders. The homeowner then schedules a work start date with the contractor. After work is complete, CEWO schedules a Quality Assurance Review. On-bill financing is used, and the monthly repayment is simply added to the homeowner's utility bill. The utility then pays back the loan portion to the lender.

Administration

- CEWO is a non-profit organization that oversees daily program operations
- CEWO works in partnership with Energy Trust of Oregon (ETO) to provide incentives and rebates
- Both CEWO and ETO work closely with banks and credit unions to provide low interest loans, and with utilities to provide on-bill repayment of the loans

Funding

- Currently funded through grants
- Initially received $13M from the Department of Energy to retrofit 6,000 homes
- Recently requested $10M from the Oregon legislature to retrofit 5,000 homes in two years
- Working to develop a financially stable revenue model that will monetize the program services

Workforce

- All CEWO contractors are Home Performance with Energy Star-qualified, have certified BPI staff members, and are vetted through the Energy Trust Trade Allies program
- On average, each home energy upgrade completed creates over 100 hours of work

Appendix I: Benchmarks

Efficiency Vermont

For residential customers interested in retrofitting their homes, Efficiency Vermont provides the following services. First, Efficiency Vermont helps customers find and connect with a certified Home Performance with Energy Star contractor that will check for air leaks, examine insulation, inspect the furnace and ductwork, and perform a blower door test using an infrared camera. The cost of an audit ranges between $200 and $500. Currently, Efficiency Vermont offers $100 rebate on audit costs, and automatically pre-qualifies customers that conducted Home Performance with Energy Star audits for other rebates and incentives.

Second, Efficiency Vermont helps customers find certified contractors in their area, and will provide an incentive of up to $2100 per household to pay for energy efficiency home improvements. Third, a contractor performs an additional blower door test to make sure that minimum requirements are achieved. In general, the retrofit process takes 6-10 weeks from start to finish, depending on the extent of work and time of the year.

Administration

- Competitive bidding process for administration
- Vermont Department of Public Works oversees 3rd-party administration
- Efficiency Vermont is responsible for planning, development, delivery and reporting on programs.

Funding

- Efficiency Vermont offers rebates to homeowners to reduce upfront costs and educate consumers on financing options
- Financing options include PACE financing, loans, and home equity loans

Workforce

- Efficiency Vermont staff is highly skilled and includes professional engineers, certified energy managers and building energy professionals
- They work with partners to conduct energy audits and report savings
- Industry standards such as BPI, ASHRAE or ACEEE are used as guidelines for training and certification program
- Workers must meet certain requirements to remain in the program

Germany Energy Efficiency Program

DENA is the organization that initiates, facilitates and implements energy efficiency projects. Customers can request home energy audits via the DENA Customer Advice Center. An Energy Consultant then conducts an on-site audit and decides on energy retrofitting measures. The Energy Consultant also provides the homeowner with a Confirmation for Loan Request, which is required to obtain a loan for energy retrofits, from KfW. The homeowner chooses from a list of various loans and grants that can be applied for. This list is maintained by KfW. The homeowner applies for the loan directly with a local financial institution. KfW will provide approval for the loan, and energy efficiency measures can then be implemented. Once work is done, a Completion of Work form must be submitted within 9 months of loan disbursement.

Administration

- DENA executes public awareness campaigns, advises and informs politicians, producers and consumers on energy efficiency developments
- DENA is also responsible for evaluating new technologies and products
- KfW bank group, as the central finance mechanism, provides access to help, funding amounts, and subsidies to minimize interest rates on loans

Funding

- German government negotiates loan conditions with KfW, who serve as the central finance mechanism
- Main source of funds comes from German government's Climate and Energy Fund
- Loan applicant submits request with local bank
- Local bank reviews and accepts application
- Local bank forwards accepted application to KfW Bank Group
- KfW refinances the loan at favorable rates and the local bank draws down the money from KfW
- Interest rates from 1.75-2.45% fixed for 10 years
- Loans are processed, managed and disbursed through applicant's local bank
- Subsidies in addition to loans are available

Workforce

- The Federal Office of Economics and Export Control (BAFA) maintain an online list of qualified energy auditors and contractors
- Energy consultants are required for the initial on-site energy consultation required for loan approval
- Loan funds are available to cover costs for construction supervisors
- Master Craftsman, or other qualified persons are required to issue Energy Performance Certificates

Hungary Energy Efficiency Co-Financing Program (HEECP)

Guaranteed funding is the focus of HEECP. In order to obtain this guaranteed funding a customer submits a signed Guarantee Request Form. The International Finance Corporation (IFC) issues a Transaction Guarantee which is reviewed quarterly. Guarantees can be provided for projects such as lighting, motors, space conditioning and automated control.

Administration

- Administering body is Hungary Ministry for Environment and Regional Policy
- International Finance Corporation (IFC) and Global Environmental Fund (GEF) jointly finance and guarantee the program

Funding

- Up to 50% of energy efficiency investments are guaranteed by IFC
- Guarantee Facility Agreements for energy efficiency transactions are executed with local financial institutions
- Transaction Guarantee Agreements are subsequently executed with individual homeowners
- In case of default, the payment is immediately released by IFC to the local financial institution who begins the recovery process

Workforce

- Locally recruited staff include bankers and energy specialists

Appendix II: Interviews

Contractor Contacts

Contact Name	Title	Organization/ Affiliation	Location	Phone	E-Mail
Ed Matos	Co-Founder/Owner	Powersmith	Babylon, NY	(631) 604-4034	info@thepowersmith.com
Robert Hamerly	Owner	Green Savers	Oregon	(541) 330-8767	roberth@greensavers.com
Jay Cohen	Co-Owner	Imagine Energy	Oregon	(503) 477-9585	info@imagineenergy.net
Phil Cecchini	Business Manager	EnergySmart of Vermont	Vermont	802-476-3549	info@energysmartvt.com
Oakley Smith	Owner	Smith & McClain	Vermont	(802)-453-5078	oakley@smithmcclain.com
Jeff Knutson	N/A	A-A Exteri-ors.com, Inc	Wisconsin	866-582-4320	jeffrey@a-aexteriors.com
Dmitri	N/A	GreenStar Home Performance	Wisconsin	715-204-4026	info@greenstarwi.com

Appendix II: Interviews

Benchmark Contacts

Contact Name	Title	Organization/ Affiliation	Location	Phone #	E-Mail
Will Schweiger	Program Director	Long Island Green Homes	Babylon, NY	631-893-2141	will.babylon@gmail.com
Matt Kilcoyne	Customer Support	Efficiency Vermont	Burlington, VT	888-921-5990	mkilcoyne@veic.org
Eric Rutz	Manager, Customer Support	Vermont Energy Investment Corporation	Burlington, VT	802-540-7691	erutz@veic.org
Eva Szalkai Csaky	IFC	IFC/Hungary Energy Efficiency Co-Financing	Hungary	N/A	N/A
Wendy Koelfgen	Market Development Manager	Clean Energy Works Oregon	Oregon	N/A	wendy@cewo.org
Ryan Clemmer	Director of Building Science and Automation	Clean Energy Works Oregon	Oregon	503-894-8665	Ryan@cewo.org
Tamara Sondergroth	Director of Operations	Wisconsin Focus on Energy	Wisconsin	N/A	tamara.sondergroth @focusonenergy.com
Jolene Sheil	Director, Focus on Energy Public Service Commission of Wisconsin	Public Service Commission of Wisconsin	Wisconsin	608-266-7375	jolene.sheil @wisconsin.gov
Jurgen Stock		Federal Ministry of Transport, Building & Urban	Bonn, Germany	N/A	N/A

Appendix II: Interviews

Montenegrin Contacts

Name	Title	Organization	Location	Phone Number	E-Mail
Marko Canovic	Deputy Minister for Housing	Montenegro Ministry of Sustainable Development & Tourism	Montenegro	+382 20 446 202	marko.canovic@mrt.gov.me
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Jasna Sekulovic	Project Manager, Open Regional Fund for South East Europe – Energy Efficiency	GIZ	Montenegro	+382 20 208 005	jasna.sekulovic@giz.de

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