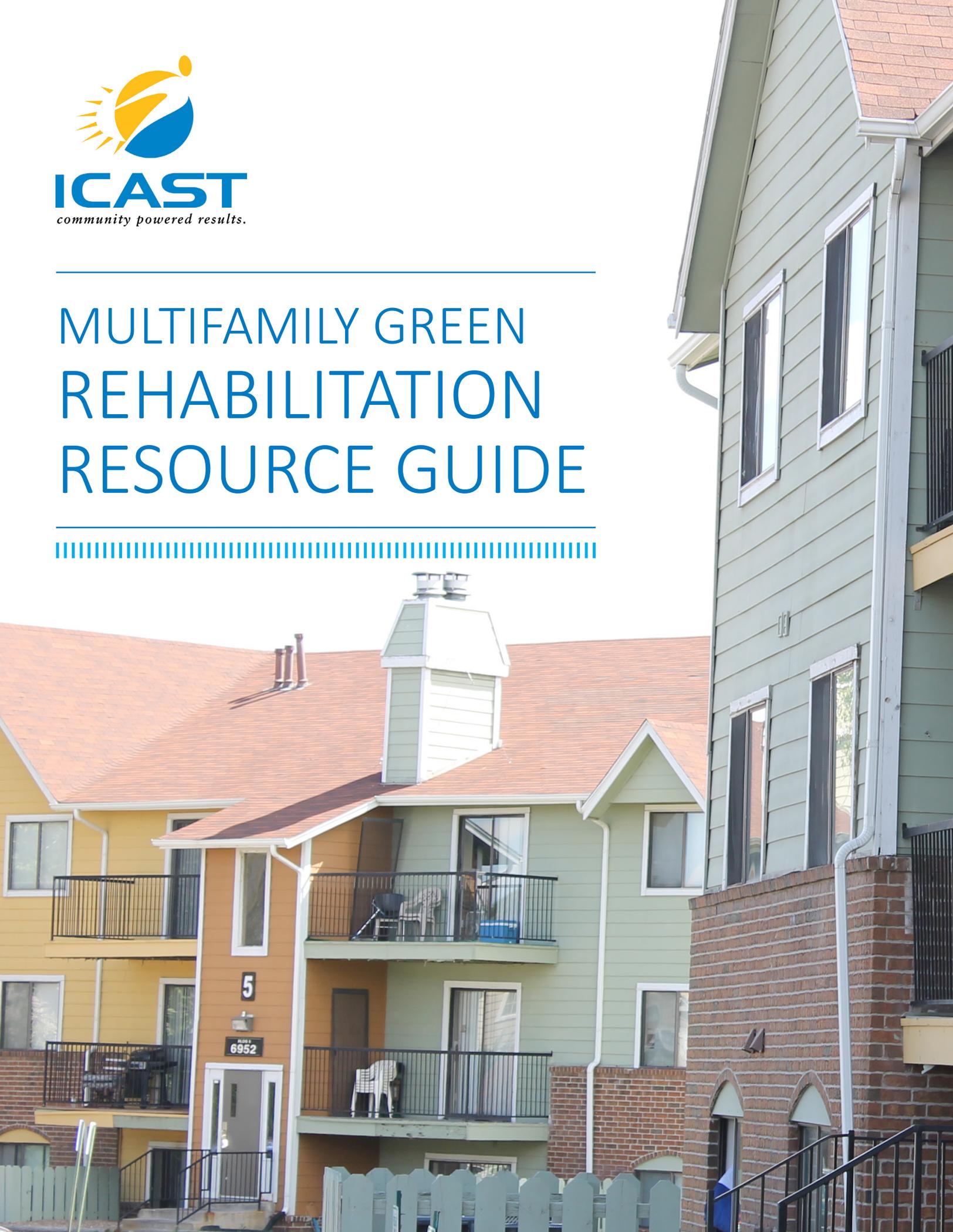




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# MULTIFAMILY GREEN REHABILITATION RESOURCE GUIDE

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# Preface

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## Enhancing the Sustainability and Affordability of Existing Multifamily Affordable Housing Properties through a Market-based Approach to Green Retrofits

Thank you for your interest in this Resource Guide to Enhancing the Sustainability and Affordability of Existing Multifamily Affordable Housing Properties through a Market-based Approach to Green Retrofits. This guide is designed to help property owners, managers and energy service companies, (collectively referred to as 'service providers') understand how to overcome market barriers in performing energy and water retrofits efficiently and effectively on multifamily affordable housing (MFAH). This publication is the result of a multi-year collaboration between the Oak Hill Fund and the International Center for Appropriate and Sustainable Technology (ICAST) aimed at reducing energy and water use in MFAH properties to reduce reliance on fossil fuels, stimulate a clean energy economy, and preserve and improve affordable housing for low-income communities.

Beginning in 2013, Oak Hill Fund made possible an ICAST project to demonstrate its methodology for incorporating the principles of sustainability in the green design and retrofit construction of MFAH. ICAST planned and designed 7 market-based, self-sustaining retrofit projects at MFAH properties across all five U.S. climatic zones. The retrofits included Energy Conservation Measures (ECMs), indoor air quality (IAQ), and water conservation (WC) upgrades. Implementation of the projects was completed through market-based financing, facilitated by ICAST, as part of its turn-key one-stop-shop approach to green rehab.

# Preface

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This guide, developed from 2015-2016, is meant to help other practitioners scale and replicate ICAST's market-based approach to green rehab in MFAH properties. It lays out the specific performance of cost-effective green rehab measures that can be applied to MFAH properties, and also addresses how to engage the owners of affordable housing properties, overcome barriers such as 'split-incentive', educate MFAH residents, and find innovative solutions that can preserve MFAH properties using a sustainable market-based approach.

The guide shares ICAST's insights and strategies on how to effectively and sustainably perform green rehab through an overview of ICAST's one-stop-shop process, resources, case studies, lessons learned from the seven demonstration projects, and details on best practices used by other service providers to perform sustainable green rehab on MFAH.

ICAST is a 501(c)(3) nonprofit founded in 2002 as a spin-off from the University of Colorado. ICAST's mission is to provide economic, environmental, and social benefits to communities in a manner that builds local capacity. ICAST specializes in green rehab for MFAH communities in Colorado, New Mexico and Texas.

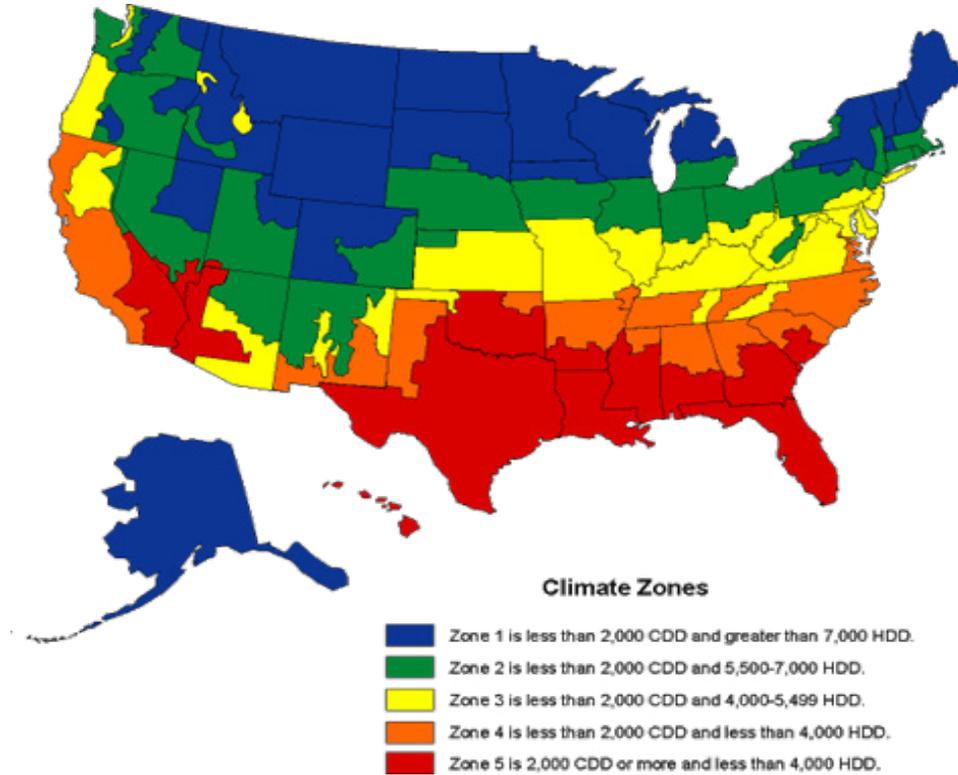
The Oak Hill Fund, located in Charlottesville, Virginia, was established in 2002 to promote the well-being of mankind through effective and inspiring grant making. ICAST is grateful to the Oak Hill Fund for their generous support and dedication to the incorporation of the principles of sustainability in the design and construction of affordable residential housing.



Ravi Malhotra  
President and Founder  
ICAST

# Introduction

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## Implementing Green Rehab Across All 5 Climate Zones

As mentioned, this Resource Guide is the result of a multi-year collaboration between the Oak Hill Fund and ICAST. The primary purpose of this guide is to help other service providers learn from our experiences and effect green rehab in MFAH properties that helps preserve and improve affordable housing for low-income communities across the nation. To make this Guide effective and relevant across the nation, ICAST deliberately chose MFAH properties across all five U.S. climate zones (using the U.S. Department of Energy's (DOE) definition of climate zones) to learn for itself and showcase the differences in performing green rehab services in different climates.

Accordingly, we covered the five climactic zones as shown on the DOE's US Climate Zone map above.

# Introduction

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The purpose of our multi-climate zone approach is to demonstrate the variety of solutions needed within the spectrum of green rehab. For example, within Climatic zone 1 (northern USA) the primary driver of utility costs is heating, while in Climatic Zone 5 (southern USA), the primary driver of utility costs is cooling. Also, local conditions, even within the same climate zone, drive many decisions. For example, in the Rocky Mountain West (where ICAST does the bulk of its work), we use the results of our HVAC audits to present building owners with a comparison of the costs and savings related to air conditioning versus swamp (evaporative) cooling, and we link the cooling cost savings to the installation of upgraded building insulation. Yet for properties in the same climate zones but in another part of the country (e.g. New York City compared to Denver, or North Carolina compared to New Mexico), the “swamp cooler” option may not be a viable option, due to high local humidity levels.

We also envision our Guidebook as a resource that local practitioners can use to both enroll affordable property owners in retrofit programs and persuade local lenders of the viability of our “market based” approach. For these purposes, we believe that local success stories as presented in the Resource Guide must relate to local conditions. Because the presentation of a successful affordable housing retrofit case study performed in Climatic Zone 1 (e.g. Minneapolis, MN) will not provide a compelling a case for a solution to property owner and lender in Climatic Zone 5 (e.g. Baton Rouge, Louisiana), we provided a range of properties with differing environmental/climactic concerns to help service providers make the case for green rehab in any climate.

What we learned is that local climatic conditions drive local solutions offered, and that the optimal green rehab available to a MFAH property is driven by its own unique needs. Each MFAH property necessitates a comprehensive site assessment to enable the design and development of optimal solutions. The case studies will demonstrate a deeper dive into the best practices and services ICAST offers, coupled with success stories to provide some perspective to demonstrate the different kinds of services and solutions MFAH properties may need.



# Market Need

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## Why Multifamily Affordable Housing?

There are two basic types of multifamily affordable housing (MFAH) properties – subsidized and naturally occurring. Tenants of subsidized MFAH typically include very low-income families and fixed-income seniors and people with disabilities. Tenants of naturally occurring MFAH typically include low- to moderate-income working families and individuals. ICAST believes that every tenant should be able to access affordable housing that is healthy, efficient, and safe. When it comes to the cost of housing, however, affordability is as much dependent on utility costs as it is on rent. When facing high utility bills, seniors on fixed income, persons with disabilities, and other low-income tenants are often forced to choose between going without food, medical care, or needed prescriptions just to keep their utilities on. In addition to putting families at risk of economic insecurity, poor air quality in inefficient and older housing often takes a toll on renters' health as well.

MFAH tenants, however, have little expectation or control over whether the properties they live in meet any standard of energy or water efficiency. The 2012 U.S. Census shows that nearly 60 percent of multifamily rental properties were built before 1980, and more than half of MFAH units available for low-income renters are at least 50 years old. While efforts to construct new and efficient MFAH properties are praise worthy, unless we rebuild our entire housing stock, the only way to truly benefit low-income communities is to dramatically expand access to comprehensive green upgrades for existing MFAH. A study commissioned by The National Resource Defense Council estimated approximately \$6.5 Billion of net benefit (after accounting for costs of the retrofits) is achievable from implementing green retrofits in MFAH across just nine states. Nationally, achieving higher efficiency standards for MFAH could be a game changing play that significantly impacts the living standards of low-income communities, while reducing energy consumption and helping solve the climate change crisis.

# Market Need

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For these reasons, ICAST focuses its green rehab services to MFAH properties. By making green rehab available for MFAH residents, ICAST reduces utility bills, freeing up money for other essentials such as food, medicines and education. Green improvements also increase the value of the MFAH properties, increase profitability through reduced turn-over rates and increased occupancy rates, and reduce operating costs from lower operation and maintenance (O&M) expenses, which helps keep properties affordable long term. In addition to the social and environmental benefits, green rehab has multiple health and safety benefits for MFAH communities, including:

- » Healthier living environments due to improved indoor air quality from better ventilation, lower Carbon Monoxide levels, reduction of mold, lead paint and other harmful substances;
- » More comfortable and productive homes due to reduced drafts, hot/cold zones, and temperature variations achieved as a result of weatherization and air sealing and better lighting in the homes;
  - » Safer environments due to better lighting in the property that eliminates dark corners.

Despite the numerous benefits of green rehab, because of various barriers (detailed in the next sections of this guide), the MFAH segment of the commercial real estate market is neglected by traditional service providers. ICAST aims to tackle these barriers in a cost-effective manner, to help service providers nationwide adopt its market-based, scalable approach to serve our most vulnerable communities.



# Barriers

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## Green Rehab Barriers in Multifamily Affordable Housing

The key market barriers for serving MFAH with green rehab include: the split-incentive; lack of knowledge and resources at the ownership level; opportunity costs from free or “low hanging fruit” programs; financing challenges; small project sizes that result in high transaction costs and prevent volume efficiency for service providers, and lack of control over tenant behavior. These barriers, which will be discussed further, have dissuaded service providers from engaging owners of MFAH, and prevented MFAH property owners from undertaking extensive green rehab, thus causing a lost opportunity for cost-effective, beneficial improvements in affordable housing stock.

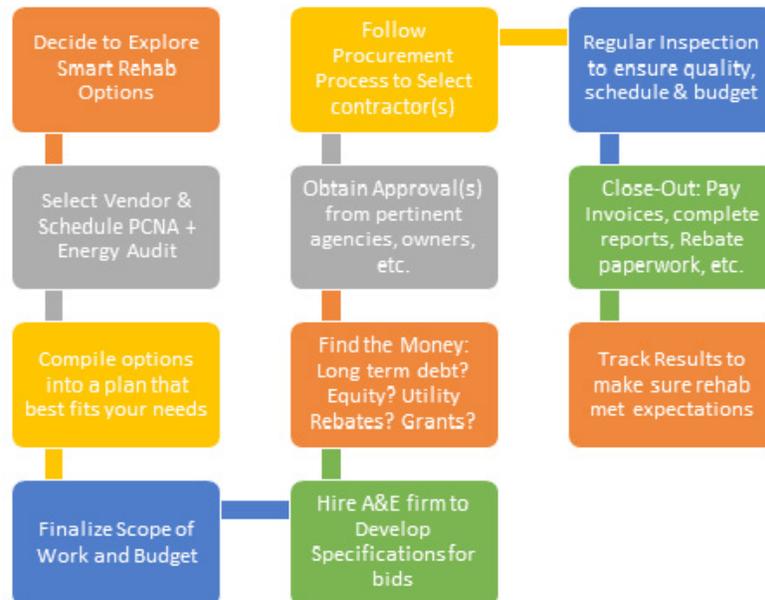
### **The Split Incentive**

Multifamily properties face a unique barrier to green rehab known as the ‘split incentive.’ Because a multifamily property owner is often not the one paying the utility bills, they are unable to capture the benefits of the utility savings from a green rehab. While property owners usually pay for water use and utilities in common spaces, it is the tenants who pay the utility bills for their own homes/apartments. This means property owners must make an investment that they cannot recuperate through the utility savings, because those savings will be captured by the tenant. Most MFAH property owners are unaware of the other benefits of green rehab such as increased property value, increased profitability through reduced turn-over and increased occupancy, and reduced operating costs, so without the incentive of recouping utility savings, they simply refuse to invest in green upgrades.

### **Small Project Size: High Transaction Costs and Lack of Volume Efficiency**

MFAH properties typically have fewer than 100 units and average 50,000 sq. ft or less. Project costs for a green rehab on a MFAH property are typically less than \$500,000. In comparison to constructing a new building or doing a total gut rehab, these are rather small projects. Yet the basics of the work, from energy audits to subcontracting to verifying and measuring energy savings, all require the same effort and process, regardless of the size of the project. This means a project generates the same transaction costs whether it is large or small. Most service providers prefer to work on a large project where transaction costs are a smaller percent of the total project costs so that transaction costs do not eat up the profits. Also, larger projects allow for more volume efficiency, which lower costs to implement the same ECMs. It is cheaper for a service provider to change out 1000 light fixtures versus taking the time and effort to show up at a site to only do 35. Many service providers cannot create efficient and sustainable services for smaller projects.

# Barriers



## Lack of Knowledge and Resources at Ownership Level

MFAH property owners have limited resources and time. Green upgrades are not only viewed as cost prohibitive, but also time-consuming and a hassle. Green rehabs require energy assessments, hiring design and engineering teams, figuring out financing, and other planning that MFAH property owners don't have the time or know-how to undertake.

When capital improvements are needed, MFAH owners are seeking the lowest cost, fastest solutions to bring their properties back to full capacity. They often wait too long to fix heating and cooling systems, resulting in emergency repairs that don't allow for long term planning, and instead result in quick fixes without capturing efficiencies or available financing and rebates for system upgrades. MFAH owners typically engage in general rehab work, turning to General Contractors (GCs) as the main service providers. Most GCs do not specialize in green rehab and aren't aware of the benefits or available resources for assistance. GCs also do not engage in energy audits or long term cost-benefit analysis of green upgrades. For these reasons, MFAH rehab projects move forward without analysis or planning around building efficiency and therefore do engage in green rehab.

# Barriers

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## Opportunity Costs from Free or “Low Hanging Fruit” Programs

In order to combat the split incentive and lack of resources in multifamily housing, two primary programs have emerged to incentivize MFAH owners to engage in energy efficiency:

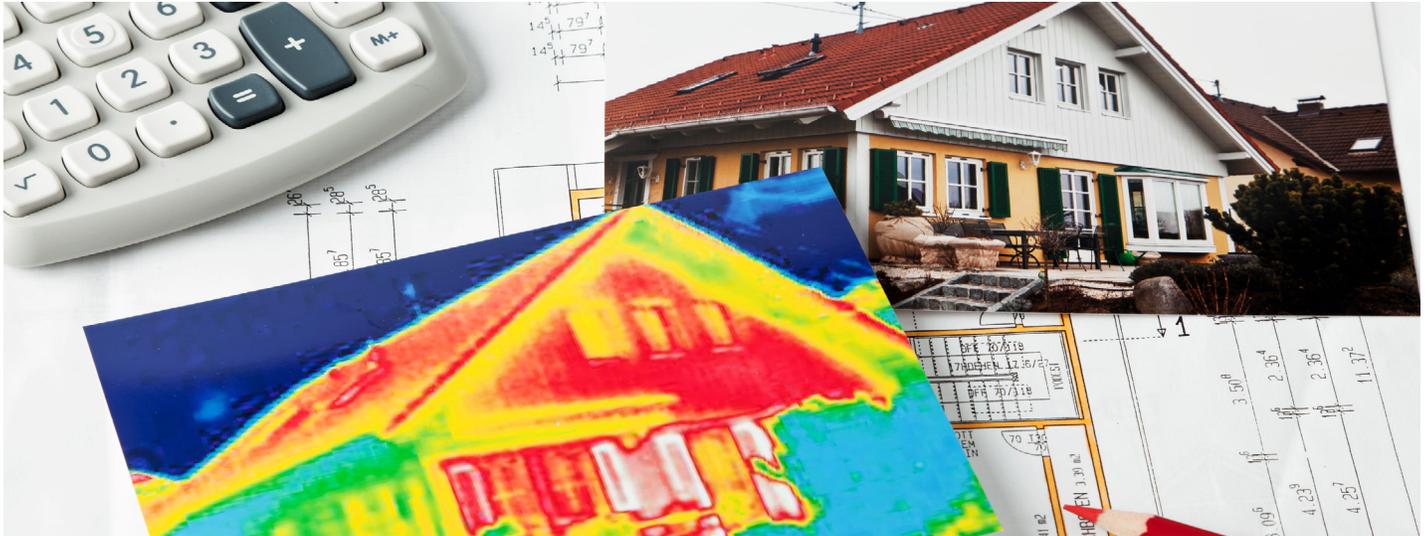
1. Weatherization Assistance Program (WAP) provides grant funds from the Department of Energy and State Agencies for ECM installations in low-income households, including multifamily properties. With limited government funds available, WAP grants typically only cover the lowest cost ECMS. Currently, with rising energy costs, and growing numbers of persons in need, these efforts barely make a dent in the need for such retrofits. A Government Accountability Office study stated that the WAP had met 5% of the demand in its first 30 years of existence.
2. Direct Install (DI) programs use funds from utility companies to provide free or highly subsidized ECMs. These are usually limited to the ‘low-hanging fruit,’ meaning low-cost, high saving measures such as low-flow devices, CFL or LED lights, pipe wraps, air and duct sealing, etc.. These green upgrades are inexpensive and have a high return on investment for the utility, but only provide an average of 5% in energy savings for the properties.

Since WAP and DI programs help multifamily property owners serving low-income households install low cost, high saving measures for free, these programs are very popular. Yet they come at a high opportunity cost. Because the subsidies don’t cover more extensive retrofits such as heating and cooling systems, appliances, windows and other shell improvements, property owners miss out on the larger ticket items that typically provide greater energy savings and health improvements. Owners often come to think that green upgrades should always be low-cost or free. When the boilers break, or the refrigerators stop working, owners expect the utility or government programs to pay for the green upgrade. When those programs are unable to do so because of limited funding available, owners do not feel the need to invest in energy saving upgrades, despite the benefits and savings they could bring to their buildings. The WAP and DI programs generate small savings, and perhaps prevent the opportunity for more extensive green rehab.



# Barriers

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## **Lack of Control over Tenant Behavior**

Even in the best case scenario, if owners can manage to work out the regulatory, financial, project size and split incentive hurdles, owners are often worried that tenant behavior will impact the results of a green rehab. Installing the most efficient solutions in an MFAH property won't help if tenants leave windows open, lights on, or taps running. Lack of understanding and ability to implement behavior change programs prohibits many owners from seeking green rehab because of concerns that tenant behavior will undercut any energy or water saving technologies that are installed.

## **Financing Challenges**

Financing a green rehab for an older property has many unique challenges. A typical green rehab is a small transaction on a property with an existing mortgage, making a 2nd position lien the best available option for financing. In addition, because many MFAH properties receive various types of government subsidy or financing, they are often subject to regulations that do not allow for additional debt. Traditional financial institutions such as banks and credit unions will not finance any project if they are not provided a first lien position due to their regulatory requirements (which require them to write-off any financing as 'bad debt' if it does not carry sufficient and appropriate collateral). Traditional financial institutions also do not like to fund small projects due to high transaction costs and low volume efficiencies. Also, most financial institutions do not recognize the associated utility cost savings from a green rehab as a new income source for the repayment of the debt on the property; so they are unwilling to lend based on the benefits of a green rehab. And since most MFAH properties do not generate sufficient cash-flow to offer repayment of the debt for a green rehab without accounting for the utility and other cost savings from the rehab, financing becomes very difficult.

# Solutions

## Solutions to the MFAH Green Rehab Gap

There are six different types of service providers who currently provide green rehab to the MFAH community. These include:

1. Energy Service Companies (or ESCOs) which typically utilize energy performance contracts (see resources for additional details) and only provide energy related rehab;
2. General Contractors (GCs), who can provide all manners of rehab but do not provide the subsidies, education, other additional green rehab help to an affordable housing owner;
3. Direct Install (DI) Program Implementers which typically work with utility companies to install energy efficiency upgrades utilizing subsidies provided through the utility;
4. WAP Implementers which typically provide subsidized weatherization upgrades for affordable housing properties;
5. Do-It-Yourself (DIY) including owners and property managers who do the necessary upgrades themselves and hire the necessary help as needed;
6. One-stop-Shop Service Providers which typically provide more comprehensive green upgrades than the WAP or DI Implementers without the rehab of a GC or comprehensive ESCO services;

After reviewing the available options and industry best practices, and through experience, ICAST has created an Enhanced One-Stop-Shop Model for Multifamily Properties to cover all of the services MFAH properties need.

Comparison of Green Rehab Service Providers							
	ESCO	GC	DI	WAP	DIY	1-Stop-Shop	ICAST
Provide Tenant and Staff Education	√					√	√
Provide Tech. Assistance						√	√
Coordinate with Regulatory Agencies	√			√	√	√	√
Provide Planning Services (EE audit, PCNA, Portfolio Analysis, etc.)	√			√	√	√	√
Oversee Design of Green Rehab	√			√	√	√	√
Oversee construction of green rehab	√		√	√	√	√	√
Oversee Design of non-green Remodel		√			√	√	√
Oversee construction of non-green re-model		√			√		√
Offer Access to Financing	√	√			√		√
Offer access to subsidies, grants, rebates, etc.	√		√	√	√	√	√

# Best Practices

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## Industry Established Best Practices in Multifamily Green Rehab

In 2006, HUD established Best Practices for Effecting the Rehabilitation of Affordable Housing, with a significant section dedicated to energy efficiency upgrades and green rehab. These best practices include (See Resources for full HUD Best Practices):

1. “Provide education and technical assistance: Education will increase the likelihood that energy efficiency is viewed more favorably and effected more readily by rehab entities.” Providing much needed education to MFAH owners helps break down perceptions that green rehab is expensive, and helping them through the process is key to being able to provide green rehab to MFAH properties.
2. “Coordinate regulatory agencies: Problems arise when there is poor communication between different sectors of government concerned with energy efficiency.” Helping affordable housing owners with the regulatory requirements they are faced with when performing rehab is an important incentive to performing green rehab; from helping with financing regulations, to utilizing EPA tools and navigating HUD and USDA requirements, it is important for a green rehab provider to assist in this process as an owners rep.
3. “Provide subsidies as needed: Incorporate grant monies available to affordable housing programs from state, federal and private sources.” Being able to educate owners on available subsidies provides a huge amount of leverage for green rehab implementers.
4. “Effect selective rehab: Successful affordable rehab entails fixing what is fixable, replacing what is broken, and adding only what is necessary for reducing costs for energy, maintenance, and operation. Instead of blindly replacing every component, each building system should be analyzed as to its condition and to maximize useful repairs for a continuing useful life.” Green rehab implementers who can provide more than green upgrades and can address other rehab needs have the advantage of being able to incorporate energy efficiency into work that already needs to be done.
5. “Use creative/layered financing: Utilize financing which involves the use of all available and appropriate sources of funding to revitalize existing properties. These sources include government programs, tax increment financing, property tax abatement, off balance sheet financing and others.” Through education green rehab implementers can help utilize creative and layered financing options which grant affordable housing owners additional options when performing rehab.

ICAST has incorporated HUD’s Best Practices into its own model, as well as other industry best practices mentioned throughout to come up with its enhanced version of a one-stop-shop service model as detailed in the following pages.

# One-Stop-Shop Overview

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## ICAST: Enhanced One-Stop-Shop for Multifamily Properties

Over the last five years, in an effort to overcome market barriers, ICAST has developed an innovative approach to multifamily green rehab: a unique “one-stop-shop” service model that cost-effectively and sustainably serves MFAH properties. ICAST’s model combines all necessary services for a green rehab and rolls them into one service delivery platform under one contract for a MFAH property owner. By making the green rehab simple and understandable, providing education and technical assistance, access to project financing, and tenant education; ICAST is able to help MFAH properties clear all of the hurdles mentioned above, to undertake a comprehensive green rehab.

ICAST overcomes market barriers by reducing the resources needed by the owner and providing assistance and education where knowledge is lacking. Planning and design assistance helps owners understand the benefits of green rehab to overcome the split incentive. ICAST overcomes the high transaction costs and low volume efficiency hurdle by designing a one-stop-shop that increases project size by offering much more than EE retrofit services, including general modeling services that are typically provided by GCs and not by other green rehab service providers.

By bundling WAP/DI low-hanging fruit ECMs (that are heavily subsidized) plus other grants and rebates with the high-cost ECMs (with few subsidies) through a comprehensive retrofit plan, ICAST generates larger energy savings while reducing costs.

In the end, ICAST’s model is even able to clear the opportunity cost hurdle of WAP and DI programs. The level of owner contribution for ICAST green rehab projects averages over 75%. This high level of investment and buy-in from the MFAH owner is what makes the ICAST model sustainable over the prevalent baseline models that rely heavily on subsidies. ICAST’s energy savings are also significantly increased by doing a deeper energy retrofit, averaging 20-30% per property. MFAH owners become educated consumers of green rehab because they understand the benefits and do not have to expend valuable time and resources to achieve green improvements.

# One-Stop-Shop Overview

## ICAST's One-Stop-Shop Service Includes:

- 1 Planning**  
Green Property Needs Assessments, Portfolio Analysis, Energy Audits, and other Planning services.
- 2 Design**  
Coordination of Scope of Work with Architectural and Engineering services.
- 3 Project Management**  
Normal text block Full property rehab with an emphasis on optimizing building performance, managing the energy efficiency and water conservation retrofit, and oversight of all subcontractors and trades on the project site.
- 4 Financing**  
Help owners access utility rebates, government incentive programs, grants, and traditional and alternative financing for the project.
- 5 Reporting**  
Provide Measurement & Verification, ASHRAE audits, and Energy Star Ratings for Green Certifications.
- 6 Tenant Engagement**  
Provide education and engagement on understanding proper functioning and use of the new green features in units and techniques for tenants to reduce their energy and water use.

	Split Incentive	Lack of Knowledge/ Resources	Opportunity Costs of Free Programs	Financing Challenges	Small Project Size	Tenant Behavior
Planning	√	√	√	√	√	√
Design	√	√	√	√	√	
Management		√	√		√	
Financing	√	√	√			
Reporting	√			√		
Tenant Training	√					√

# 1

## Planning

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### **Best Practice: Educate Ownership and Identify Opportunity**

*One of the most effective way to educate Multifamily Housing Ownership is to provide comprehensive energy audits to identify the energy efficiency needs of their properties. The industry standard for these audits are Green Physical Needs Assessments (GPNA) and ASHRAE Audits. These types of audits combine traditional capital needs assessment methods and energy audit methods to give a comprehensive picture of how a property can be improved and where energy efficiency fits in.*

ICAST's overarching planning strategy is a synergistic combination of proven, traditional best practices of planning, with additional innovative services to meet specific needs of MHAH properties. First, ICAST provides a property assessment to analyze the areas of need both for energy conservation methods (ECMs) and necessary improvements to capital needs and operations as identified by the owner, property manager, and maintenance staff. This assessment includes a walkthrough of the whole building with the owner or staff, to provide education and understanding of the building's energy needs and opportunities, while collecting information on general rehab concerns and requests from staff.

ICAST then completes an energy audit report using a whole building approach that reviews historical energy use and evaluates the property for deep-retrofit options. A detailed report with net installed costs (obtained from subcontractors) and predicted energy savings from energy modeling for each ECM recommendation is presented to the owner, demonstrating the payback by option presented. This audit allows owners to make informed decisions on the ECMs they need to install based on how important the improvement is to the owner, versus how much energy it will save, versus cost. The owner has the opportunity to discuss and understand whether tenant behavior can impact the ECM, and get a cost-break down of how the utility savings will be captured.



# 1 Planning

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The ICAST planning process also provides information on what rebates and financing are available to the owner, and projections on cost savings from maintenance and operations, and increase in property value. By having the cost-benefit analysis, along with information about rebates and financing, the owner is able to overcome hurdles such as the split-incentive and lack of resources through proper financial planning and understanding of all costs and benefits.

ICAST also offers planning to meet specific needs of multifamily properties. Green Property Needs Assessments provide a long term overview of needs for addressing major physical components of a property, with a focus on energy and water infrastructure improvements. Portfolio analysis services are available for multifamily property owners with a portfolio of multiple properties, demonstrating which properties are the larger energy users, helping property owners strategically plan their green rehabs in the most cost-effective and efficient way possible. These services both utilize tracking tools available through the U.S. Department of Housing and Urban Development and the Environmental Protection Agencies Portfolio Manager. For more information on these tools, please see the Resources Section of this guide.



# Planning Case Study: DMA Plaza



Green Retrofit of 126 units in an 11 story high-rise apartment building with senior residents, located in DOE Climate Zone 4.

## Scope of Work

Fluorescent lighting was upgraded throughout the facility from T-12 bulbs to more energy efficient T-8s, and hallway and exit sign lights were replaced with LEDs. To improve temperature stability, the exterior doors were equipped with weather stripping. A rubber membrane with an R-19 ridged board was installed in the storage/mechanical room on the building's roof. This room was also outfitted with a room air seal and ceiling with an R-19 insulation. One of the critical projects ICAST worked on was replacing the HVAC system. This included the installation of Lochinvar AWN801PM condensing water heaters, a Grundfos Alpha pump, a Leonard TM-2020 thermostatic mixing valve, associated piping, fittings, hangers and supports to connect into the existing system, new water heaters, new flue piping and condensate disposal, line and low voltage wiring, electrical, concrete coring, and pipe insulation.



# Planning Case Study: DMA Plaza

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## General Findings

### Savings

- Average annual savings of \$15,708/year
- 25% reduction in electricity costs
- 332,670 kWh saved
- 338 Tons of CO2 kept from the atmosphere every year

### Energy Star Score

Pre-Rehab

▶ 16

Post Rehab

▶ 37

## Planning

ICAST's project team, identified several ECMs that would yield substantial energy savings with its standard assessment process including: the replacement of the existing electric domestic hot water plant with energy efficient gas-fired boilers; replacement or retrofit existing lights with energy efficient LEDs; and weather stripping at exterior doors. Of the recommendations put forth by ICAST, the primary source of cost savings on electricity resulted from the fuel switching of the DHW system from electricity to gas. It was in the planning stage that these substantial savings were identified and were the deciding factor in driving the ownership to perform the green rehab.

## 2 Design

### **Best Practice: Make Energy a Part of Larger Rehab**

*ICAST has learned through the utilization of its model, that MF property owners often will not pursue rehab that focuses solely on energy efficiency. The reasoning often being the negative assumptions about high costs and low incentive, ICAST has overcome this hurdle by targeting MF property owners that are already in need of general rehabilitation for their properties. ICAST's innovation lies in bundling the low-hanging fruit ECMs (that are heavily subsidized) with the high-cost ECMs (with few subsidies) and providing the owners with a comprehensive retrofit plan that also generates larger energy savings.*

During the design phase of a green rehab, ICAST utilizes the developed energy audit and property assessment to create the initial scope of work (SOW) and related specifications for the project. ICAST also works to incorporate any other general rehab desired by the MFAH owner into the project, and manages bids for that work. By offering more than just energy improvements, ICAST is able to reduce the barriers from small project sizes and high transaction costs. Incorporating general rehab into the project also helps the MFAH owner accomplish more of their goals in one project versus planning and spending on multiple types of rehab projects over the course of a few years.

During the design phase, ICAST works with the designated architect and engineering subcontractors to incorporate drawings and needed certifications into the SOW. The SOW is then developed into a bid book, while ICAST staff builds the list of potential subcontractors who will be asked to bid on the project. ICAST also analyzes and finalizes the amount of grants and rebates available to reduce the cost of the project, and determines how those grants and rebates will be captured through different available local, state, and federal programs.



# Design Case Study: Overland Trail



Green Retrofit of 48 MFAH units in DOE Climate Zone 5.

## Scope of Work

Replaced 48 old and wasteful furnaces with high performance, 95% efficient, systems. Installed 48 high performance (14 SEER) split-system air conditioning units. Removed and installed 258 single high performance (U .33) windows. Installed a vapor barrier, increased insulation, and ventilated the apartment's six crawlspaces. Air sealed all building penetrations, and replaced and preset 47 water heaters with models with a minimum performance energy Factor of .657.



# Design Case Study : Overland Trail

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## General Findings

### Savings

- Utility energy savings add up to an estimated \$11,221/year
- 28,080 kWh Saved
- 17,264 Therms of Natural gas saved
- 26 Tons of CO2 kept from the atmosphere every year

## Design

This green retrofit project utilized energy savings to subsidize urgently needed maintenance work on the property. The crawlspace was uninsulated and with significant moisture issues that ultimately would have led to serious damage. By insulating, sealing, and ventilating this space future expenses were eliminated while saving money in the process.

# 3

## Project Management

### **Best Practice: Incorporate Available Programs and Incentives**

*ICAST's model has been successful in part due to the network of partnerships it has created and knowledge it has gathered on available incentive programs for energy efficiency. Becoming an expert in incorporating and managing these programs allows ICAST to educate owners on the options available and secure funding that may have otherwise been unavailable. These types of incentives include: local, state and federal grants, weatherization monies and utility rebates. In many cases a rehab will qualify for one or several of these incentives and can be used to leverage MFAH owners into seeing energy efficiency work as more attractive.*

ICAST manages the rehab projects on a day-to-day basis, from oversight of subcontractors to all invoicing and payments. ICAST has a list of identified contractors available in each service area who can bid with competitive prices and perform the quality work expected. ICAST also manages the weatherization or direct install programs available to the property owner and handles the required paperwork for engaging those services. By managing the full rehab and not just the energy portion, ICAST eases the resource hurdle for property owners, reducing time spent on the project, while bringing in additional funding from available programs, and increasing project size for greater business sustainability.



# 3

## Project Management



ICAST is exclusively focused on residential properties, mainly apartment units. From experience, ICAST has learned that relocating tenants for a rehab should be the exception, not than the rule. By managing the project for property owners on their timeframe, with accommodation for their needs, while respecting the schedules of their tenants, ICAST makes green rehab easy for property owners without disrupting tenants.

### ICAST looks for the following in a contractor before selecting them:

- ✔ Ability to comply with required policies and procedures
- ✔ Experience
- ✔ Cost
- ✔ Scope of Work it can perform
- ✔ Their Infrastructure
- ✔ Health and Safety procedures and record
- ✔ Operating Procedures
- ✔ Ability and record to meet timeline
- ✔ Openness to receiving training
- ✔ Openness to performing training duties
- ✔ Ability to expand or condense work crews
- ✔ Ability to be receive payment on a 30 day cycle

# Project Management Case Study: Olin Apartments



Green retrofit of 107 unit apartment serving primarily disabled residents, located in DOE Climate Zone 5.

## Scope of Work

Lighting throughout the facility was upgraded from T-12 bulbs to more energy efficient T-8s, exterior lighting including front entry, flood lighting and canopy lighting was replaced with high efficiency LED bulbs. The shell of the facility was upgraded with R-40 insulation being added to the 5th floor of the building. The buildings boiler and DHW lines were wrapped in an ASJ fiberglass wrap to increase efficiency.



# Project Management Case Study: Olin Apartments

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## General Findings

### Savings

- Average annual savings of \$10,563/year
- 12.84% reduction in electricity costs
- 85,041 kWh saved annually
- 1788 Therms saved annually
- 76.5 Tons of CO2 kept from the atmosphere every year

### Financial Details

- Utility rebate 4% of cost
- Grant Subsidy 46% of cost
- Customer Investment 50% of cost
- Simple Payback on Customer Investment: 3 Years

### Energy Star Score

Pre-Rehab ▶ 56

Post Rehab ▶ 60

## Project Management

This property was retrofitted while fully occupied. Because this can be a stressful process, ICAST preformed resident engagement services while completing work on the units. Residents reported positive interactions with the subcontractors on-site and had opportunities to provide input on the rehab process. ICAST management discovered that tenants had an upcoming holiday party, and as a result, decided that the community dining areas should be retrofitted first. The retrofits resulted in making the common areas substantially more comfortable by increasing insulation and improving the temperature control, all in time for the residents to enjoy the use of the room for their holiday event.

# 4

## Financing

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**Best Practice: Understand and Tailor Financing Options:**

*If an energy efficiency implementer wants to be successful in the multifamily property market they need to understand the various financing programs created to address the industries challenges, including state financing, tax deductions, and incentives.*

Financing a green rehab for an older multifamily property has many unique challenges. It takes a unique understanding of utility payback, useful life of improvements, and how to layer the different incentives, regulations, and programs for alternative financing into one loan. ICAST uses its energy audit and projected savings to help owners demonstrate an income stream for any financing needed for their properties to help get better and longer-term financing to make projects successful.

ICAST provides technical assistance to MFAH property owners, helping them understand the various financing options and government incentives, grants and rebates that can help reduce project costs. ICAST helps owners partner with local Community Development Institutions (CDFIs) and other alternative lending programs to help them secure third position liens and other kinds of necessary financing. ICAST’s program leverages locally available weatherization funds and works with local utilities to capture any rebates or direct installs of EE upgrades offered to lower overall project costs from the start. ICAST also incorporates subsidies such as tax credits and MACRS depreciation, and financing programs such as Property Assessed Clean Energy (PACE).

For more information on these tools, please see the Resources List in the Best Practices Section of this guide.



# Financing Case Study: Solar Vista



Solar Vista is a 28 unit multifamily building located in DOE Climate Zone 5.

## Scope of Work

Unit lighting was replaced with CFL's and each of the units showerheads were replaced with low flow showerheads to make water usage more efficient. The attics insulation was upgraded to R-38 and weather stripping and door sweeps were installed on all exterior doors. All units thermostats were replaced with programmable models and single pane windows throughout the building were upgraded to vinyl frame thermopane. Lighting throughout common areas the facility was upgraded from T-12 bulbs to more energy efficient magnetic ballast with 28w bulbs and other outdoor lighting was replaced with LED's. The buildings 28 furnaces were replaced with 95% efficient models, and venting for the furnaces was installed within the building. Additionally, 14 older refrigerators were replaced in the rehab and the basement storage area and walls were insulated.



# Financing Case Study: Solar Vista

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Before



After



## General Findings

### Savings

- Average annual savings of \$10,997/year
- 12,000 kWh saved annually
- 11,352 Therms saved annually
- 75.6 Tons of CO2 kept from the atmosphere every year

### Financial Details

- Total Project Costs: \$250,486
- Grants Subsidy: \$120,486
- Loans: \$130,000
- Terms: 3yr. 6.75% Fixed

### Energy Star Score

Pre-Rehab ▶ 56

Post Rehab ▶ 82

## Financing

The Solar Vista project utilized a loan provided by the Triple Bottom Line Foundation, ICAST's CDFI partner dedicated to financing green rehab of affordable housing properties. The project was financed with a \$130,000 loan which is on track to be paid off within 3 years.

## 5 Reporting

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### **Best Practice #1: Utilize Measurement and Verification Tools**

*The use of M&V tools is crucial for monitoring energy usage and to ensure that projected savings are realized. These tools help gather knowledge of ongoing operating expenses, allowing you to strategically plan to manage buildings that are highly inefficient, incorporate better practices, and replicate practices employed in efficient buildings. Regular and standardized energy data collection also plays an important role in portfolio management. There are multiple tools available, the EPA's Portfolio Manager being the standard as it is tied to several incentive programs and the Energy Star Rating and Certification system.*

### **Best Practice #2: Offer Industry Certifications for Results**

*As regulatory requirements and increased demand for sustainable housing increase, so to do the prestige of industry certifications such as ENERGY STAR and LEED. These types of certifications can also be linked directly to government incentives and act as an additional "carrot" for multifamily housing owners looking to improve the quality and value of their properties.*

ICAST provides reporting to MFAH customers to help them understand the utility savings they receive as a result of the green rehab. ICAST works cooperatively with residents and owners to collect the data directly from the local utility company. Each month after ECM installation, ICAST compares pre-implementation utility billing information (gathered during the audit process) to post-implementation billing data. ICAST employs EPA's Portfolio Manager to input the data and obtain weather normalized output of pre and post ECM comparisons. ICAST utilizes the Portfolio Manager outputs to create its proprietary reports that provide additional information to assess the performance of the ECMs installed, including:

1. Utility Rate Normalization (to provide normalized cost savings reports to the customer)
2. Environmental and social benefits including Carbon savings and jobs created due to the project

ICAST also offers additional reporting and certification services desired or required for multifamily properties. These reports and certifications can often be used for securing outside funding or financing. ICAST uses Portfolio Manager to track energy information needed to rate properties for an Energy Star Certification, available from the Department of Energy, or for an ASHRAE Level 3 audit, a more intensive, full building analysis of energy use. For more information on these certifications and tools, please see the Resources List in the Best Practices Section of this guide.

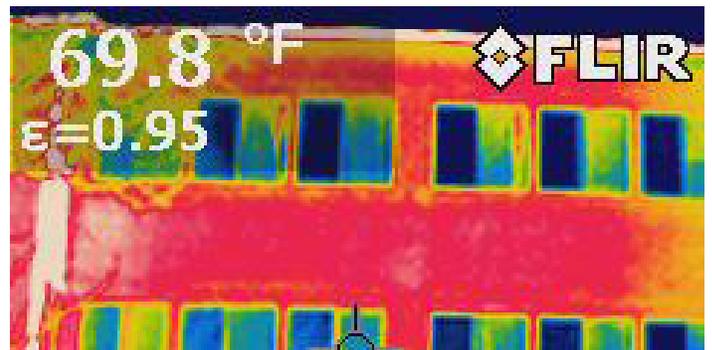
# Reporting Case Study: Mount Massive



Green retrofit of a 24 unit apartment building, located in DOE Climate Zone 7

## Scope of Work

Lighting throughout common areas the facility was upgraded from T-12 bulbs to more energy efficient T-8s. Unit lighting was also replaced with CFL's and other outdoor lighting was replaced with LED's. The attic of the building was reinsulated to R-49 insulation. The attic furnace ducts were also wrapped and the attic was air sealed to improve the seal of the building. All the furnaces in the attic were replaced with more energy efficient models. The crawlspace in the building was also repaired with insulation being redone, wraps being installed on exposed water lines and vapor barriers being added. Individual units received more efficient showerheads and aerators, as well as wrappings for the water lines of electric heaters and programmable thermostats. The building also had more energy efficient window seals installed and timers for air purifiers added to all common room areas.



# Reporting Case Study: Mount Massive

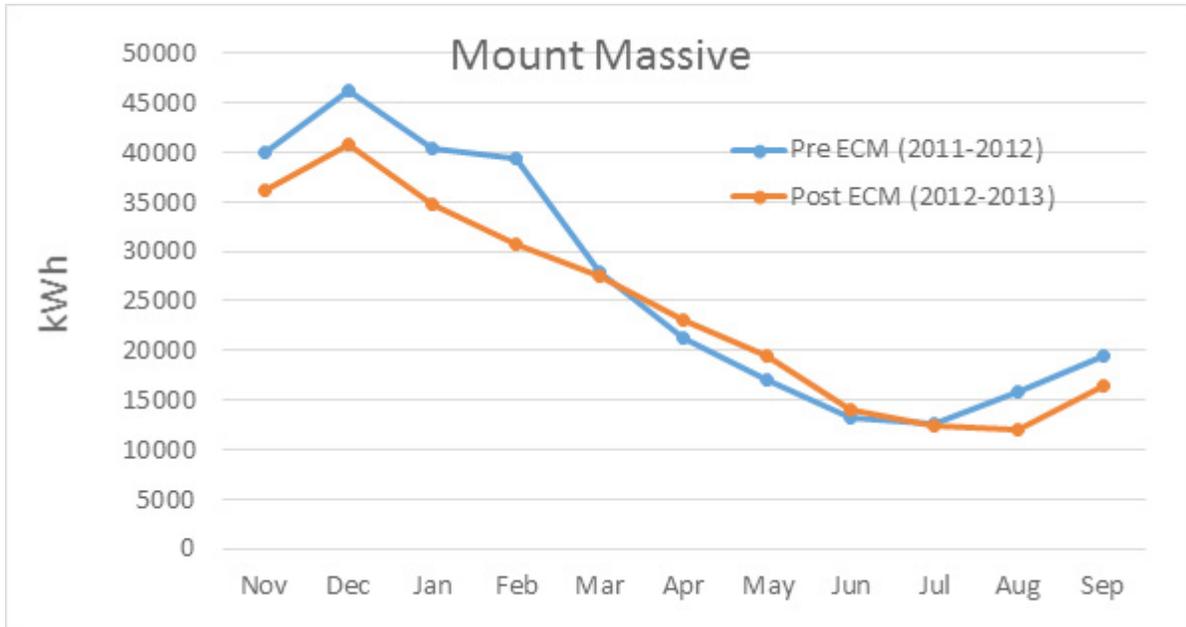
Before



After



# Reporting Case Study: Mount Massive



## General Findings

### Savings

- Average annual savings of \$8,675/year
- 63,942 kWh saved
- 49.5 Tons of CO2 kept from the atmosphere every year

### Energy Star Score

- Pre-Rehab  
▶ 31
- Post Rehab  
▶ 59

## Reporting

Data from the property was analyzed for a full year before and after energy conservation measures (ECM's) were installed. This reporting shows a substantial decrease in kWh used post ECM installation which resulted in 28 point increase in Mount Massive Apartment's Energy Star rating.

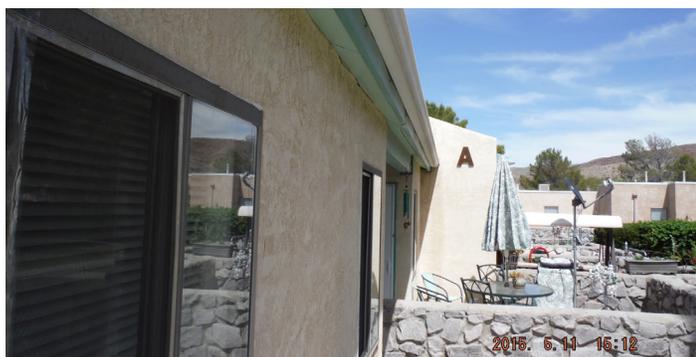
# Reporting Case Study: Hacienda Orgullo Apartments



Green Rehab of 33 units located in DOE Climate Zone 3

## Scope of Work

The attic of the building was reinsulated to R-40 insulation. The attic furnace ducts were wrapped and the attic was air sealed to improve the seal of the building. Additionally, the seal of the building was improved via the addition of blower door guided air sealing and replacement of unit windows with vinyl frame thermopane units. Unit lighting was replaced with CFL's and each of the units kitchen's lighting was replaced with LED tubes. The Furnaces in the building were replaces with 95% efficient condensing models, and programmable thermostats were added to each apartment. In each unit, aerators and showerheads were replaced to make water usage more efficient. Each unit also received the installation of smoke detectors, CO detectors and ASHRAE fans to improve safety. The hot water piping in every apartment was insulated and wrapped. Additionally, 9 of the least energy efficient refrigerators were identified and replaced with energy star models.



# Reporting Case Study: Hacienda Orgullo Apartments

Before



After



# Reporting Case Study: Hacienda Orgullo Apartments

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## General Findings

### Savings

- Average annual savings of \$12,607/year
- 11,503 kWh saved annually
- 6382 Therms saved annually
- 49.5 Tons of CO2 kept from the atmosphere every year

### Energy Star Score

- Pre-Rehab  
▶ 67
- Post Rehab  
▶ 83

## Reporting

Since this property is owned by a member of the Better Buildings Challenge, the owners have already committed to entering their utility data into Portfolio Manager and make green upgrades that reduce energy and water consumption by 20% by 2020. Data from the property was analyzed for a full year before and after energy conservation measures (ECM's) were installed. This reporting shows a decrease in energy consumption post ECM installations of 677,877,208 BTU's, which resulted in an Energy Star score increase of 16 points.

# 7

## Tenant Behavior Change

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### **Best Practice: Utilization of Behavior Change**

*The habits and behavior of the residents and maintenance staff at a MF property is perhaps more important than technology driven green rehab, to not only instigate but also maintain the utility savings. The most efficient HVAC system loses its effectiveness if residents leave their windows open or if maintenance staff do not change the air filters regularly and maintain the HVAC system to its optimal functioning capability.*

ICAST provides a Behavioral Change program to educate tenants and staff on the best way to use the new energy efficiency and water conservation solutions that have been installed in their property, and to learn additional ways they can save on their utility bills through behavioral changes. This educational program is provided on-site through door-to-door visits to maximize the benefits of the green rehab and to educate residents on the ways they can personally impact their utility bills.

ICAST focuses its education for tenants based on age. Children receive activity based learning such as coloring books around energy savings, while seniors can participate in games and activities like 'Conservation Bingo.' Residents receive a variety of educational information from ICAST, including 'pledge cards' to instigate residents to sign up for various conservation efforts. ICAST initiates competitions among residents to achieve energy savings, which keep residents engaged and help them enjoy the education process. ICAST has found that public recognition of energy savings achievements and awards such as pizza parties are the best way to encourage participation and learning, and ultimately lead to tenant energy use behavior change. When MFAH property owners and maintenance staff also participate, tenant engagement programs can produce significant results that help reduce MFAH owner fears regarding limited energy saving results.

# Tenant Behavior Change Case Study: Kappa Towers



Green Retrofit of 45 senior housing units, located in DOE Climate Zone 5

## Scope of Work

Lighting throughout the units and common area space was upgraded from T-12 bulbs to more energy efficient T-8s, with outdoor and rooftop lighting replaced with LEDs. The booster water heater in the building was replaced with a tankless gas fired unit to increase efficiency. ICAST installed a new energy efficient control system to control water temperatures. This system allowed for outdoor temperature reset of the cooling tower and heating boilers and also warm weather shut down of main circulation pumps. This optimizes the use of varied temperatures of heated water to be coordinated with the cooling tower, pump, damper, and fan. The system also included installation of sensors at varied locations within the piping system in the mechanical room.



# Tenant Behavior Change Case Study: Kappa Towers

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## General Findings

### Savings

- Average annual savings of \$7,894/year
- 39% reduction in electricity costs
- 71,041 kWh saved annually
- 1931 Therms saved annually
- 66.3 Tons of CO2 kept from the atmosphere every year

### Energy Star Score

- Pre-Rehab  
▶ 39
- Post Rehab  
▶ 56

## Tenant Behavior Change

ICAST conducted a resident engagement program focused on behavior change for energy consumption reduction by the tenants and maintenance staff. This tenant engagement included trainings and distribution of educational materials and some of the savings noted below can be attributed to the effectiveness of the tenant engagement.

# Resources

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- **PACE** – Property assessed clean energy (PACE) is a method of financing energy efficiency upgrades or renewable energy installations for buildings. Depending on state legislation, PACE can be used to finance water efficiency products, seismic retrofits, and hurricane preparedness measures. More info at- <http://energy.gov/eere/slsc/property-assessed-clean-energy-programs>
- **Pay-For-Success-** Pay for Success (PFS) is an approach to contracting that ties payment for service delivery to the achievement of measurable outcomes. The movement towards PFS contracting is a means of ensuring that high-quality, effective social services are working for individuals and communities. More info at- <http://www.payforsuccess.org/learn-out-loud/pfs-101>
- **Energy Performance Contracts:** Energy Performance Contracting (EPC) is an innovative financing technique that uses cost savings from reduced energy consumption to repay the cost of installing energy conservation measures. More info at- [https://www.energystar.gov/ia/partners/spp\\_res/Introduction\\_to\\_Performance\\_Contracting.pdf](https://www.energystar.gov/ia/partners/spp_res/Introduction_to_Performance_Contracting.pdf)
- **Energy Star Certification:** ENERGY STAR certified buildings and plants meet strict energy performance standards set by EPA. They use less energy, are less expensive to operate, and cause fewer greenhouse gas emissions than their peers. Starting with the first ENERGY STAR certified building in 1999, tens of thousands of buildings and plants across America have already earned EPA's ENERGY STAR for superior energy performance. More Info at: <https://www.energystar.gov/buildings/about-us/energy-star-certification>
- **ASHRAE Audits:** The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) defines three levels of audits. Each audit level builds on the previous level. As audit complexity increases, so does thoroughness of the site assessment, the amount of data collected and the detail provided in the final audit report. This effort can translate into higher energy savings. Where to find Audit Providers: <http://www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities/resources/technical-assistance-providers-database>
- **Portfolio Manager:** Portfolio Manager is an interactive resource management tool that enables you to track and assess energy and water use across your entire portfolio of buildings ... all in a secure online environment. More importantly, it can help you implement every step of your energy management program, from setting a baseline and identifying which buildings to target to setting goals and tracking improvements. It's also the tool for getting recognition from EPA for your efforts. More info at: <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager>
- **Green Property Needs Assessments:** A GPNA is a physical inspection that evaluates a building's existing conditions as well as its energy and water consumption patterns. The assessment will identify all physical improvements and low-cost energy/water conservation measures that are necessary to ensure the building's long-term physical and financial viability. HDC and HPD's GPNA combines a standard Physical Needs Assessment (PNA) or Capital Needs Assessment (CNA), often required by lenders to access financing, with an energy audit appropriate to the building size. Where to find GPNA Providers- <http://www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities/resources/technical-assistance-providers-database>
- **Department of Energy: Database of State Incentives for Renewables & Efficiency** -<http://www.dsireusa.org/>
- **Other M&V Service Providers-** WegoWise <https://www.wegowise.com/>, BrightPower <http://www.brightpower.com/solutions/find/energyscorecards/>.
- **Enterprise Green Communities Toolkit-** <http://www.enterprisecommunity.com/resources/ResourceDetails?ID=0086077>
- **HUD Multifamily Affordable Housing Rehab Best Practices-** Source- U.S. Department of Housing and Urban Development- <https://www.huduser.gov/portal/publications/affhsg/bestpractices.html>



**ICAST: International Center for Appropriate and Sustainable Technology**  
ICAST is a 501c3 nonprofit specializing in the smart rehabilitation of existing multi-family properties. ICAST provides a one-stop-shop approach to multifamily property rehab. This encompasses all aspects of the assessment, planning, design, construction management, reporting, financing and actual execution of all repair work for a rehabilitation project.

For more information visit [www. ICASTusa.org](http://www.ICASTusa.org)

