



EEFA & GHHI Case Studies

- Examination of both health and energy outcomes of weatherization and energy retrofitting projects performed at affordable multifamily housing properties in EEFA states
- Produced to provide narrative descriptions that demonstrate how energy retrofitting addresses home health hazards, how families directly benefit from these investments

Scope of Work	Number of Studies	Avg. Cost Per Unit
Limited	6	\$21,712
Comprehensive	6	\$124,655

Location	Number of Studies
Urban	7
Suburban	3
Rural	2

Number of Units	Number of Studies
60 or Fewer	5
61-100	5
100 or More	2

Median Original Year Built: 1958



Case Study: Commons at Imperial Atlanta, Georgia

Cost of Intervention: \$11,469,000 (\$127,433 per unit)

Pre-Intervention

- High-rise building constructed in 1911
- 90 Units
- Property comprehensively rehabbed 2014, serves previously homeless individuals
- Energy retrofitting planned with Southface Energy Institute



Weatherization Interventions

- Energy efficient windows
- R-20 spray foam insulation
- Continuous R-30 roof insulation
- High efficiency HVAC system
- Programmable thermostats and utility monitoring
- Energy Recovery Ventilator (ERV)
- Energy Star appliances and electric water heating
- High efficiency LED and CFL lighting

Healthy Homes Interventions

- Paint stabilization to reduce lead hazards
- Low VOC paints and sealants
- Pest management services
- Mold remediation
- Installation of fire sprinkler systems and alarm system
- Installation of carbon monoxide detectors
- Water Sense Certified low-flow toilets and shower heads installed
- Drought resistant landscaping

Outcomes:

- Total annual energy savings: \$52,000
- Energy use dropped by 32 percent
- LEED Gold Certification
- 100% occupancy, 500+ on waiting list



Case Study: Commons at Imperial Atlanta, Georgia

Donna Werkheiser

Pre-Intervention Situation:

- History of homelessness and economic insecurity related to health conditions
- Chronic conditions include asthma, bronchitis, and emphysema

Intervention Services:

- One of the first tenants to move into the renovated building in 2014
- Case manager on-site assisted Werkheiser to apply for disability benefits and healthcare coverage

Outcomes:

Health Costs 12 months pre-intervention: \$30,000 | 12 months post-intervention: \$676



Othinel Jenkins

Pre-Intervention Situation:

- Sarcoidosis (chronic disease causing shortness of breath and inflammation)
- Aspergilloma (chronic infection that impacts pulmonary function)
- Lost job in inventory management and housing due to health conditions

Intervention Services:

- Moved into the Imperial in April 2014
- Case manager assisted him to apply for disability coverage and Medicaid
- Medication management to reduce frequency of breathing treatments

Outcomes:

No breathing treatments in past 16 months | enrolled in vocational school



Case Study: Park Terrace Apartments Rockford, Illinois



Pre-Intervention

- High-rise building constructed in 1984
- 183 Units
- Rockford Housing Authority developed plan in 2013 with goal to reduce energy use by 20% portfolio-wide
- Developed Energy Performance Contract with Johnson Controls for 9 properties



Cost of Intervention: \$1,033,290 (\$5,646 per unit)

Weatherization Interventions

- High efficiency condensing boiler
- ENERGY STAR appliances
- Efficient faucets
- Air sealing
- Resident Education (Efficient Living Program)

Healthy Homes Interventions

- Heat recovery ventilation system
- Smoke free policy
- Smoking cessation support for tenants
- Healthy homes resident education

Outcomes

- 21.36% savings in electric usage
- 34.39% savings in natural gas usage
- \$39,539 annual reduction in utility costs
- Reduced O&M costs



Case Study: Annunciation Inn New Orleans, Louisiana

Pre-Intervention

- 6 story building constructed in 1982
- 106 Units
- Occupied by people ages 62+
- Comprehensively rehabbed in 2008 post Hurricane Katrina
- Green Coast Enterprises contracted for energy audit & green retrofit in 2014



Cost of Intervention: \$74,200 (\$700 per unit)

Weatherization Interventions

- Packaged Thermal Air Conditioning (PTAC) heat pumps
- HVAC service and replacement schedule
- Upgraded interior and exterior lighting

Healthy Homes Interventions

- Noise machines for control of car traffic noise (residents were running water to cancel out ambient noise)
- Identified unreported maintenance needs (leak repairs)

Outcomes

- 13% decrease in water usage
- 13% decrease in power usage
- \$10,535 annual reduction in utility costs
- Reduced O&M costs
- Improved thermal comfort

Case Study: Harwill/Cole/Harrington Apts. Detroit, Michigan



Pre-Intervention

- 3 Multifamily Buildings constructed 1920s
- 60 Total Units
- Owned and managed by Southwest Housing Solutions
- Units rehabbed in 2012 to improve efficiency and reduce operating costs



Cost of Intervention: \$315,250 (\$5,254 per unit)

Outcomes

Weatherization Interventions

- Roofing retrofit (reflective shingles)
- ENERGY Star kitchen appliances and hot water tanks
- Exterior repairs and tuck-pointing to reduce leakage
- Insulation replacement
- Weather-stripping at doors and windows

- 15% decrease in monthly energy costs
- Increased life cycle of appliances and other property features
- Reduced O&M costs
- Improved thermal comfort



Case Study: Viking Terrace Worthington, Minnesota

Cost of Intervention: \$4.7 million (\$78,333 per unit)

Pre-Intervention

- Multi-family development constructed in 1974
- 60 Units
- Damaged exterior siding
- Outdated furnaces, electrical system, appliances
- Leaking roofs, damaged foundations
- Pest infestations, mold and radon
- Property comprehensively rehabbed 2006-2007

Weatherization/Efficiency Interventions

- Geothermal heating and cooling system
- ENERGY Star windows and appliances
- Dual flush toilets
- Pitched roofs
- Environmentally-friendly siding
- Improved landscaping
- High quality ventilation system

Healthy Homes Interventions

- Low VOC paints and sealants
- Pest management services
- Mold remediation
- Radon remediation
- Sealing to reduce moisture intrusion and air leakage
- Smoke free policy adoption (2013)



Outcomes:

- 46% reduction in energy use
- 39% reduction CO2 emissions
- Reduced O&M costs
- Improved indoor air quality/VOC reduction

Case Study: Viking Terrace Worthington, Minnesota (Tesfazghi Family)



Mulugheta Tesfazghi

Pre-Intervention Situation:

- Mulugheta and his wife have resided at Viking Terrace for 14 years
- Trouble controlling temperature in winter and summer
- Holes in floor around heating furnace
- Pest infestations
- Stress from living conditions

Intervention Services:

- HVAC system upgrade
- New windows, appliances, flooring repairs
- Integrated Pest Management

Outcomes:

- Electricity bills reduced by \$20-50 per month
- Improved indoor air quality, reduced noise
- Reduced stress, improved satisfaction with property
- Healthy pregnancy, daughter now 7 years old



Case Study: Mill Pond Apts. (Coffman Family)

O'Fallon, Missouri

Pre-Intervention

- Multi-family building constructed in 2008
- 52 Units
- Efficient HVAC, windows and ENERGY Star appliances
- High levels of dust observed in some units
- Additional efficiency upgrades and health interventions completed in 2013

Weatherization Interventions

- HVAC system tune-up and cleaning
- High quality air filter installation
- Installation of efficient thermostats

Healthy Homes Intervention

- Ionic air purifiers and oxidizers used to remove particulate matter



Tina Coffman

Pre-Intervention

- COPD diagnosis
- Polyps blocking air flow in sinuses

Post-Intervention

- Cleared from specialty medical care
- No emergency department visits
- Increased ability to exercise (lost 30 pounds)

Cost of Intervention: \$74,200 (\$700 per unit)

Outcomes

- Improved air quality (reduced particulate matter)
- Reduced O&M costs
- Improved thermal comfort

Case Study: Lincoln Mills (Martinez Family) Manville, Rhode Island



Pre-Intervention

- Multi-family building constructed in 1906
- 98 Units
- Inefficient conditions at Lincoln Mills (air leakage from doors and dryer vent)
- History of injury and child with elevated lead levels at previous place of residence

Weatherization Interventions

- Single unit weatherization
- Insulation door kits
- Dryer vent kits
- Window seals
- Efficient light bulbs

Healthy Homes Intervention

- Smoke Alarms installed



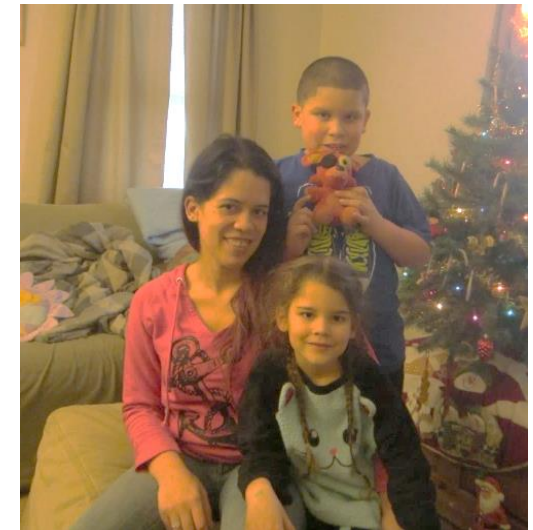
Cost of Intervention: \$767

Outcomes:

No injuries, lead free kids, reduced utility costs

Avoided medical costs of **\$610 in first six months**

Resident reports gas bills are **\$50-100 lower per month**





Case Study: Liberty Village Apartments Richmond, California



- Asthma prevalence double national average (17% to 8%)
- Long-term residents more likely to have asthma vs short term residents
- Hospitalization rate of children due to asthma is double the California average
- Residents concerned about air quality with presence of petrochemical plants

Pre-Intervention

- 99 units built in 1942
- Needed upgrades to
 - energy efficiency
 - water conservancy
 - reduce air leakage

Interventions

- High efficiency showerheads and faucets
- ENERGY STAR water heaters and refrigerators
- Increased roof insulation
- New light fixtures
- New furnace wall units
- Efficient, double pane windows

Cost of interventions:
\$22,000 per unit or
\$2.19 million total

- Outcomes:**
- Greater level of comfort
 - Improved indoor air quality

Utility	Annual Reduction	Annual Savings
Gas	8,051 Thms	\$8,856
Electricity	29,278 kWh	\$4,392
Water	880,563 Gal	\$1,761



Case Study: Cottages and Gardens at Chesapeake in Elkton, Maryland

Pre-Intervention

- Originally built in the 1980's
- Single-site (90 units)
- Two buildings managed separately
- Energy inefficient
- Outdated building systems



Energy Efficiency Interventions

- Central HVAC and heating systems
- Energy efficient appliances and lighting
- Improved piping and plumbing features
- Energy efficient windows
- Blow-in insulation

Healthy Housing Interventions

- Pest Management
- Americans with Disabilities Act compliant
- Sealing to reduce moisture and air leakage
- Installation of smoke alarms

Project Cost:

\$12,220,463 or \$124,698 per unit

Case Study: Cottages and Gardens at Chesapeake in Elkton, Maryland



Marian Creswell:

- Homeless for 30 days before moving into the Chesapeake, where she's lived for 22 years
- Prior to the rehab:
 - Experienced a draft from her bedroom windows
 - Moisture from pipe leakage damaged ceilings
 - Noisy wall AC/heating unit generated poor quality air
- After the rehab:
 - She enjoys a quieter AC/heating system with improved air quality
 - Less stressed because appliances and HVAC stay in good, working condition

"I am never moving out because the combination of income-adjusted rent, lower utility bills, and comfortable living is ideal for a 72-year old"





Case Study: 1351 Greene Ave. Brooklyn, New York

- Brooklyn has undergone massive change in the past few decades
- Rising rents have forced many low-income renters out of the area
- The Ridgewood-Bushwick Senior Citizens Council manages over 1800 units of affordable housing in Brooklyn



Energy Efficiency Interventions

- Energy efficient Windows
- Upgraded Lighting
- Efficient boiler and furnace
- Improved building insulation
- Replaced ventilation system
- Roof and masonry repairs

Healthy Homes Interventions

- Mold Remediation
- Electrical and plumbing repairs
- Asbestos abatement
- Pest management
- Sealing to reduce moisture intrusion and air leakage
- Fire safety measures

Project Cost: \$1,085,000 (\$180.833 per unit)



Case Study: 1351 Greene Ave. Brooklyn, New York



Teresa Yanes and Derian De La Torre:

- Lived in this apartment since 1992
- Temporarily relocated during renovation
- **Outcomes**
 - Increased protection from extreme temperatures
 - Derian, a college student, enjoys increased productivity with better, efficient lighting
 - Reduced stress levels
 - Increased disposable income

Average Monthly Pre-Rehab
Utility Costs

\$250

Average monthly Post-Rehab
Utility Costs

\$78

Property-wide outcomes

- Reduction in mold and mildew
- Noticeable reduction in pests
- Improved air quality
- No raise in rents
- Lower utility bills





Case Study: Temple I Apartments Philadelphia, Pennsylvania

- Originally built in the mid-1860s and redeveloped in 1994
- Temple I went through rapid deterioration after years of mismanagement



Energy Interventions:

- Low E Energy Star windows and doors
- New plumbing features
- Individual high-efficiency split systems for heat/AC
- Closed-cell spray foam and additional insulation
- Energy Star light fixtures
- 85% of construction waste diverted from landfills to recycling facilities

Healthy Housing Interventions:

- Mold and radon remediation
- Integrated pest management
- No-VOC and non-toxic finishes
- Hydrochlorofluorocarbon (HCFC)-free mechanical systems
- Sealing to reduce air leakage and moisture

First domestic offset program supporting carbon reducing efforts through green affordable housing

Total Construction Cost	\$9.5 million
Construction cost per unit	\$158,333
Total Soft Cost	\$8.5 million
Total Development Cost	\$18 million



Case Study: Temple I Apartments Philadelphia, Pennsylvania

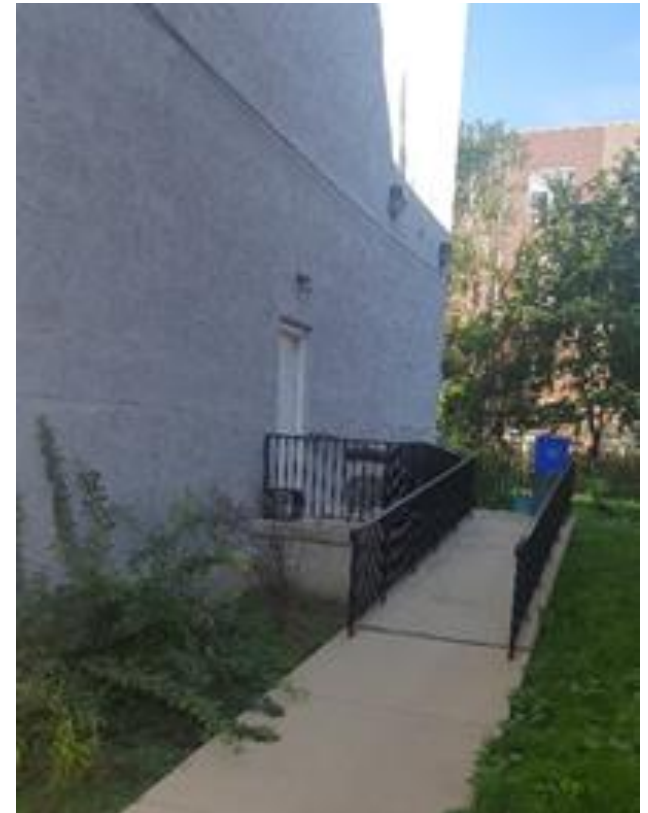


Ms. Franklin

- Suffers from Arthritis, Type-1 diabetes, COPD, and numerous respiratory diseases, including asthma
- After the rehab, she has had to go the doctors 3 times less than she used to

Property Outcomes

- Improved air quality
- Elimination of mold
- Lower utility bills
- Neighborhood crime reduction



Average Monthly Pre-Rehab Utility costs

\$400

Average Monthly Post-Rehab Utility Costs

\$80

Total Medical Costs 3-Year Pre-Rehab

\$2,175

Total Medical Costs 3-Year Post Rehab

\$1713.97



Case Study: Warwick SRO Apartments Newport News, Virginia

Pre-Intervention Conditions

- Originally built in 1928 (88 units)
- Occupied by previously homeless individuals
- Inefficient appliances
- Aged gas boilers and standard electric water heaters
- Lacked fresh air system for common areas and individual units
- Air and water leakage from windows and walls

Outcomes

- EarthCraft multifamily certification
- 50% reduction in energy usage
- Fewer respiratory issues and other negative health impacts

One-Time Benefits to Local Economy:

Local business income = \$527,838

Local wages and salaries = \$2,248,663

Total local income from construction = \$2,776,502

Taxes and fees from construction = \$328,920

Local jobs in construction and other industries = 34

Energy Interventions

- Variable Refrigerant Flow (VRF) heating and cooling systems
- High efficiency water heaters
- ENERGY STAR light fixtures, dishwashers, and refrigerators
- High efficiency windows
- Upgraded plumbing

Healthy Housing Interventions

- Roof replacement
- Corridors and units air sealed
- New HVAC systems paired with Energy Recovery Ventilators (ERV)

Project Cost: \$4,292,300
(\$48,776 per unit)