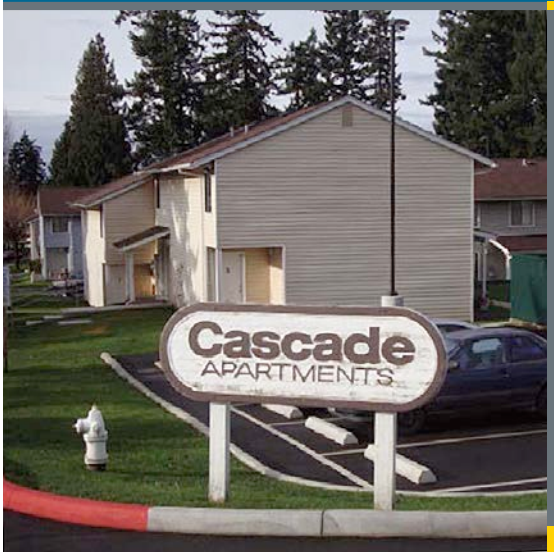


Building America Case Study

Whole-House Solutions for Existing Homes

# Cascade Apartments – Deep Energy Multifamily Retrofit

Kent, Washington

## PROJECT INFORMATION

**Construction:** Retrofit

**Type:** Multifamily, affordable

**Builder:** King County Housing Authority, Kent, Washington
*http://www.kcha.org/*

**Size:** 108 units in 27 four-plexes

**Rent:** 30% of household income

**Date completed:** 2010

**Climate Zone:** Marine

## PERFORMANCE DATA

State low-income weatherization investment:

$385,850 for all 108 units

$15,850 per 4-plex

$3,858 per unit

Site savings per unit:

Billing analysis: $23/month (22%)

TREAT: $33/month (30%)

SIR of weatherization-funded measures: 1.67

Community-wide energy savings:

1,254,974 kWh per year (source)

During 2009-2010, the King County Housing Authority (KCHA), a member of the U.S. Department of Energy team, Building America Partnership for Improved Residential Construction (BA-PIRC), implemented energy efficiency upgrades in the Cascade multifamily community in Kent, Washington. These improvements resulted in annual energy cost savings of 22%, improved comfort and air quality for residents, and increased durability of the units.

Built in the 1960s, the Cascade Apartment community includes 25 two-story apartment buildings and two one-story apartment buildings. Each building has four apartments, for a total of 108 units with common walls. The buildings are wood framed with pitched roofs and vented crawlspaces. The units are all electrically heated with zonal baseboard heat controlled by wall-mounted thermostats, and all units have 50-gallon electric water heaters.

Cascade is an ethnically diverse community that includes people who originate from Russia, Sudan, Ethiopia, and other cultures. This diversity led to communication challenges for the owner in conveying how to operate the equipment as intended, and for the occupants in conversing about problems with building operations.

The goal of the energy retrofits was to address several deficiencies, including excessively high utility bills and moisture levels, which directly impacted the financial and physical health of the community members.

The KCHA staff conducted energy audits of the units, which included multipoint blower door tests, assessment of existing insulation, and review of moisture-related issues. These audits included the use of Building America partners' tools such as the Fluke Ti32 Thermal Imaging equipment and software, The Energy Conservatory blower doors, and TECHLOG2 software.

Working with local contractors, KCHA proposed nine retrofit measures that were designed to reduce energy use, increase comfort and indoor air quality, attenuate sound, and increase building durability.

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## Key Energy Efficiency Measures

### HVAC

- Install energy recovery ventilator in each apartment – 66% efficiency

### ENVELOPE

- Air seal and insulate attic – R-38
- Dense pack walls and rim joist with cellulose insulation – R-14
- Install ENERGY STAR® double- pane, low-e+Ar, vinyl windows – U = 0.30
- Re-insulate floors – R-30
- Install new doors with a solid urethane foam core and thermal break – R-5, U = 0.20

### LIGHTING, APPLIANCES, AND WATER HEATING

- Install 100% CFL bulbs
- Install low-flow sink faucets/aerators and shower heads

For more information, see the Building America report, *Cascade Apartments: Deep Energy Multifamily Retrofit,* at *www.buildingamerica.gov*

Image credit: All images were created by the BA-PIRC team.

Installation of dense-pack cellulose wall insulation by Arrow Insulation helped reduce heating energy use by more than 40% at the retrofitted Cascade Apartments in Kent, Washington.

## Lessons Learned

- The utility billing analysis suggests average energy savings of 10,691 kWh per year, a 22% reduction. These results are typical of comparisons of modeled and measured energy use. The utility billing analysis suggests significant savings from the retrofit measures, with the majority of the savings (over 40%) coming from heating energy use.
- TREAT was selected as the research analysis tool because at the time, the current version of BEopt could not be used to assess complex multifamily structures such as Cascade. TREAT also provides the opportunity to "true-up" the predicted energy use from the model to actual energy use.
- Savings-to-investment ratios (SIRs) could not be determined for individual retrofit measures because there is no established methodology for identifying the reduction in air leakage from dense wall pack insulation and from window and door retrofits. Assigning air leakage reductions to insulation, window and door retrofits in multifamily apartment is a key area for future work in order to better assess the SIR of the individual measures.
- Each unit realized approximately $23 in monthly utility savings, which will continue throughout the life of the units.
- Relocating the whole-house ventilation system to the main area of the home per ASHRAE 62.2 provided a positive benefit to the occupants. KCHA staff has noted a significant decrease in indoor air quality complaints from occupants since the retrofits took place.
- Some occupants were concerned that the continuous operation of the energy recovery ventilator (ERV) would reduce comfort and raise utility bills. The KCHA staff educated the occupants about the operation and benefits of the ERVs, which helped increase understanding and acceptance. KCHA staff will continue to engage occupants on the use and purpose of the ERVs.

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