

King County Housing Authority

Avondale Manor

Boulevard Manor

Briarwood Apartments

Forest Glen

Project Narrative

Projects were prioritized for consideration of funds, based upon critical envelope, thermal and air barrier inefficiencies and the capacity to lower energy and water consumption to achievable levels, coupled with an effort to improve the indoor air quality of the living environments.

The Projects

Avondale Manor is multi-family property at 17107 NE 80th Street in Redmond, Washington. The twenty units within five, two-story buildings were constructed in 1969 of wood frame construction. The average unit size is 1076 square feet.

The units were equipped with energy efficient ductless mini-split system heat pumps in the lower floor rooms of the units, while the electric baseboard heaters were left in place in the upper floor rooms. Attics were reinsulated and a 'Cool Roof' TPO roofing was installed.

Boulevard Manor is a mixed population resident property at 12039 Roseberg Avenue South in Seattle, Washington. The seventy unit, four story building was constructed in 1969 of masonry construction. The average size of a unit is 484 square feet.

The units were equipped with energy efficient ductless mini-split system heat pumps in the living room areas, while the electric baseboard heaters were left in place in the bedrooms. A new cladding system with a vapor and air barrier, drainage plane, rigid foam insulation, and a durable, post-consumer, cementitious and metal siding materials, and high efficiency double glazed windows were installed. Additionally, rigid foam insulation was installed at the foundation perimeter.

Briarwood Apartments

Briarwood is a mixed population resident property at 18026 Midvale Avenue North, Shoreline Washington. The seventy unit, three story building was constructed in 1970 wood frame construction. The average unit size is 571 square feet.

The vented roof was replaced with a 'Cool Roof' TPO roofing membrane and rigid foam insulation, improving the thermal barrier at the roof to an R-38. A durable, post-consumer, cementitious and metal siding materials, and high efficiency doors and double glazed windows were installed, and air sealing was performed at the building envelope.

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Forest Glen is a mixed population resident property at 13137 107th Place NE, Kirkland, Washington. The thirty nine units, within seven buildings, were constructed in 1969 wood frame construction. The structures were built onto a sloped, heavily wooded property, with a small portion of the units situated below grade, below upper units. The average unit size is 537 square feet.

Attics were reinsulated and new roofing materials installed. First generation, vinyl siding was removed and replaced with a durable, post-consumer, cementitious siding materials and high efficiency doors and double glazed windows were installed. The units were equipped with energy efficient ductless mini-split system heat pumps in the living rooms of the units, while the electric baseboard heaters were left in place in the bedrooms.

Additionally, at all four properties;

Department of Energy, Tier 1 measures were implemented, low flow toilets were installed and the bathroom fans were upgraded and automated controls installed.

Overall, thermal and air barriers were improved by adding insulation to the attic spaces and exterior walls and providing adhered materials and integration of penetrations, to air seal at the exterior walls. High efficiency, doors (R-5) and double glazed windows w (U-.28-.30), were installed and efforts were made, when re-constructing balconies, to eliminate thermal bridging.

Mechanical ventilation was upgraded and energy efficient, split-system heat pump equipment installed has the capacity to filter circulated air, contributing to the improvement of indoor air quality.

Renewables were given consideration, though funding prevented efforts to decrease energy consumption through these type measures.

Pre-Retrofit Analysis

The project teams utilized a number of techniques including energy modeling, engineering calculations and site audits to produce the baseline energy and water consumption metrics for the properties.

The baseline data was compared to data from other housing authorities using the HUD Utility Benchmarking Tool, to prioritize the properties in terms of where the greatest opportunities to save energy were.

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These baselines were then used to predict savings from efficiency measures implemented into the project scopes of work.

KCHA used the energy modeling software TREAT, from Performance Systems, to convert the actual building energy consumption into estimates of energy used at each system within the buildings.

The energy models were then used to predict the savings from a range of efficiency measures proposed by the consultants.

The data collected, from the Benchmarking and TREAT Modeling efforts, was reviewed and compared to the Department of Energy's EQuest energy modeling program to reduce the risk of over predicting savings due to modeling. Physical assessments provided an additional preventative measure to improve the accuracy of the baseline and savings estimates.

Once validated, the selection of the final packages of measures proposed were weighed to meet both the objectives of the housing authority's desire to save on energy and water use, as well as meeting the needs of the residents and consideration to improve living environments.

Energy Efficiency Strategy

Measures enacted to obtain included the installation of new highly insulated doors, energy efficient double glazed windows, air sealing and additional insulation at exterior walls, floors, and attics, and improving the air and thermal barriers.

The combined energy measures implemented are estimated to save 18-35% of the residents annual energy use based on energy modeling analysis.

Water Efficiency Strategy

KCHA used billing data from the water utility at each property to produce a site specific baseline value for water consumption, on a per day basis. The baseline data was compared to the baseline water use across all KCHA properties and the HUD Utility Benchmarking Tool to identify the properties with the greatest potential for water savings from efficiency measures. The project team researched products that could meet the performance specifications that were generated as a result of the engineering analysis.

Consumption reduction measures undertaken throughout the units and common areas included the installation of Water Sense qualified toilets (1.6 gpf) and Department of Energy, Tier 1 type measures;

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High efficiency showerheads (1.75 gpm) and low flow aerators (1.0-1.5 gpm) in the bathroom and kitchen faucets were installed. The Tier 1 measures were implemented early on in each project to begin reduction of water use.

These measures were calculated to save almost 30% of each resident's annual water use, based on historical billing data. The products selected were determined by prospective efficacy and resident satisfaction.

Post Retrofit Analysis- Performance Verification

Performance verification will be obtained with building commissioning, green assessments and resident education activities.

During and post construction, third party independent consultants will perform building commissioning to confirm installation accuracy as well as performance verification. KCHA will perform post construction blower door testing to validate performance and provide updated TREAT modeling analysis for review, to confirm efficacy of measures implemented, and troubleshoot sites where savings are significantly below the estimated potential.

Part of the performance verification phase will be to extend the efficiency measure analysis to include a holistic assessment of other measures that could provide additional benefits to residents including indoor air quality improvement and green materials, and the 'greening' of operations and maintenance practices.

Resident education is a critical portion of the ability to support the physical improvements made at each site. Up to an additional 5% savings in energy and water use could be achieved by engaging residents and empowering them to consciously conserve resources where they can. A variety of media and on-hands training education strategies are focused to overcome language and cultural barriers.

The project teams collected available pre and post retrofit billing data, cleaned data to eliminate anomalies and identify before and after usage and determining average consumption representing a 365-day period.

The post retrofit data was then weighted against pre retrofit data to obtain calculated 'Total Savings'.

The result of post retrofit reporting for the four projects is in progress at this time. Analysis is in progress at Boulevard Manor, continues at Briarwood and Forest Glen and will be performed in the near

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future at Avondale Manor. Analysis will continue to collect current performance data for up to another year and provide compelling evidence that the goals were achieved.

In the interim, indoor air quality has been improved, contributing to healthy living environments for the residents.