California Energy Commission
Public Interest Energy Research (PIER) Program
ENVIRONMENTAL ENERGY RESEARCH

Energy and Indoor Environmental Quality Retrofits in Low-Income Apartments

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PIER Environmental Research
www.energy.ca.gov/research/environmental

August 2011

Fact Sheet

The Issue

Buildings are responsible for about 40 percent of the total U.S. energy demand and carbon dioxide emissions, and building stock changes slowly. Therefore, to meet targets for building energy efficiency, the performance of existing buildings must be improved. California is embarking on an aggressive building energy retrofit program. Retrofit programs provide the opportunity to simultaneously improve energy efficiency and indoor environmental quality, which are associated with reductions in carbon dioxide emissions and improvements in the health and comfort of occupants. At present, however, most retrofit programs seek only to save energy.

About one-third of California's population lives in multifamily buildings. Apartment residents often have below-average incomes and sometimes reside in old and poorly maintained units with elevated concentrations of harmful contaminants. Thus, energy efficiency and indoor environmental quality retrofits of apartment buildings serving low-income populations are becoming a priority. This project will develop and demonstrate approaches for retrofitting low-income apartments to simultaneously save energy and improve indoor environmental quality conditions.

Project Description

The broad goals of the project are to develop methods for retrofitting low-income apartments to achieve energy savings and simultaneous indoor environmental quality improvements, and to quantify the resulting energy and indoor environmental quality benefits. In this context the project is developing protocols for selecting optimal retrofit packages. The retrofit selection protocol identifies candidate retrofits, estimates the energy and indoor environmental quality benefits per unit cost and provides a ranked list of the most suitable retrofits. The protocol considers retrofits in four categories: ventilation with outdoor air, thermal comfort/heating and cooling, indoor pollutant source control, and appliances.

The major elements influenced by this project: people, energy/air quality and apartments.
Source: bigstock.com

A group of presumptive retrofit measures are recommended whenever feasible because their benefits are documented and they are either required by current standards or have limited costs. The remaining available resources per apartment are allocated to retrofits based on the outcomes of a benefit analysis of the candidate retrofits. The highest priority retrofits are selected based on analysis of benefits in three basic categories: energy, indoor air

quality, and comfort. Estimates of the retrofit costs are also a selection factor. In addition to physical retrofits, the project includes tenant education about maintaining energy efficiency, indoor air quality, and comfort in their apartment.

The project will apply the retrofit selection protocol to retrofits in 15 to 18 apartments, 5 to 6 each in three apartment buildings. Before and after retrofit implementation, the research team will perform indoor and outdoor environmental measurements and collect energy consumption data. Based on analyses of the data collected from the retrofitted apartments and from unretrofitted control apartments, the energy savings and the indoor environmental quality improvements will be quantified. The retrofit implementation and measurements will be performed in different seasons and up to three California climates to investigate the influence of weather conditions on the benefits. Additionally, through a pre- and post-retrofit survey, tenant satisfaction with the retrofits will be evaluated.

More information about the project can be found at: http://arei.lbl.gov

PIER Program Objectives and Anticipated Benefits for California

This project will help California move toward energy-efficient, healthy, and comfortable apartments for low-income tenants. Building owners and companies performing retrofits will benefit from the retrofit selection strategy that accounts for projected energy savings, indoor environmental quality impacts, and retrofit costs. Moreover, agencies subsidizing low-income housing will gain improved tools for deciding how to use their scarce resources appropriately.

The findings from this project will also demonstrate and quantify the attainable energy savings and indoor environmental quality improvements. Nonprofit and governmental organizations, energy agencies, and policy makers will gain a better understanding of the specific retrofit measures available in low-income apartments and of the associated extent of energy savings and indoor environmental quality improvement. Finally, the study results will expand knowledge of the mechanisms by which retrofits influence energy consumption and indoor environmental quality conditions.

Project Specifics

Contract Number: 500-09-022
Contractor: Lawrence Berkeley National Lab
City/County: Berkeley, Alameda County
Assembly District: 14
Senate District: 9
Application: Nationwide
Contract Amount: $1,750,000
Cofunding: $250,000 from the U.S. Department of Energy
Contract Term: 05/10/2010 – 01/31/2014

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CEC-500-2011-FS-019