Residential Recessed Downlights

Recessed downlights are the most popular installed lighting fixtures for new and remodeled homes. In 2000, a study in California found that 60 percent of homes built since 1990 contain recessed cans. A study in the northeastern states found that new homes had an average of 23 recessed cans per home. The vast majority of all installed recessed downlights in the United States use incandescent light sources. In the California study, only 0.4 percent of recessed downlights used compact fluorescent lamps (CFLs).

Although precise numbers of the installed stock of residential recessed downlights are not available, PNNL estimates there are at least 350 million currently installed in US homes. According to the Census Bureau, around 20 million are sold each year.

Energy Efficiency

Recessed cans represent a significant energy savings opportunity in residential lighting, due to their prevalence and the inefficiency of currently available products.

To address energy waste by recessed downlights, the Recessed Downlights project is promoting energy-efficient downlights with the following features:

- Pin-based CFLs rated to last 10,000 hours
- Airtight housing
- IC-rated for direct contact with insulation
- Electronic ballasts
- Fixture efficiency of at least 50%
- Light output minimum of 900 initial lumens, net of fixture losses.

State Energy Codes

Building codes in many states require recessed cans installed in the building shell to be airtight (meeting ASTM E283). Airtight cans prevent heated or cooled air from escaping into the attic. In fact, all states that have adopted the 1995 Model Energy Code (MEC), or newer have this requirement on their code books. To date, 33 states, representing more than 67 percent of the US population, have adopted such codes. California is currently considering new building energy standards that would require airtight, IC-rated recessed downlights in addition to its existing requirement that fixtures used in kitchens and baths be high efficacy (i.e., fluorescent).

Technical Challenges

High-efficiency recessed downlights face unique operating challenges. High temperatures can affect both the light output and life span of a CFL and the associated ballast. In an airtight recessed can installed in insulation, heat generated by the operation of the lamp and ballast has little opportunity to dissipate, causing the temperatures within the can and around the ballest to rise.

Recessed Downlights: Energy Users

Recessed downlights are also known as recessed "cans" or "high hats." They are the most commonly installed fixtures in new and remodeled homes. Typical recessed downlights can waste energy in two ways: 1) by using incandescent light bulbs drawing 60-100 watts each; and 2) by allowing conditioned air to "leak" into unconditioned spaces, such as attics, thus driving up heating and cooling costs.

Competitive Solicitation

The goal of the Recessed Downlights Project is to encourage fixture manufacturers to develop and bring to market high-efficiency recessed cans that perform well in airtight, insulated ceilings.

Through a competitive solicitation administered by Pacific Northwest National Laboratory (PNNL), several new, energy-efficient recessed downlights are available at specially negotiated prices. The following products have successfully completed laboratory testing and are now available.

PowerLux®
Model P120N26

D-Light
Models 8545 and 8546
(with 26 watt lamps)

TCP Models 13726 and 13426

Visit our website for more detail and information on how to order: www.pnl.gov/CFLdownlights

Product Testing

Each of the recessed downlight models listed above has successfully completed rigorous testing in a simulated insulated ceiling environment (with R-45 insulation). The fixtures were subjected to the following tests within this environment:

- Short-term test: continuous ON operation for 12 hours; to measure temperature at the ballast case, lamp base, and the ambient air surrounding the lamp. Temperature of the ballast case must remain below the rated maximum in order for the fixture to pass the test.
- Long-term test: cyclic operation (3 hours ON, 20 minutes OFF) for 12 months; to verify fixture longevity in the insulated ceiling environment and to measure lumen depreciation over time. To pass this test, fixtures must operate without failure for the duration of the testing period. (This test simulates approximately eight years of typical fixture operation.)

Project Sponsors and Partners

- U.S. Department of Energy
- Consortium for Energy Efficiency
- Long Island Power Authority
- National Grid USA
- Natural Resources Defense Council
- Northeast Energy Efficiency Partnerships
- Northwest Energy Efficiency Alliance
- NSTAR Electric
- Sacramento Municipal Utility District
- United Illuminating
- WI Energy Conservation Corporation
- Wisconsin Focus on Energy

For Product Information

D-Light	www.downlight.net
PowerLux®	www.powerlux.com
TCP	www.tcpi.com

For Program Information on the Web:

http://www.buildings.gov

For Project Information:

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Recessed Downlights Website:

www.pnl.gov/cfldownlights

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

U.S. Department of Energy
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