Code Considerations for Appliances, Lighting and Miscellaneous Electric Loads in Florida Homes

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Research Purpose and Goal: This research proposes to investigate energy used for lighting, appliances, and miscellaneous electric loads (MELs) in new Florida homes for the purpose of determining their contribution to total energy use, and if these end uses should be addressed in more detail within the Florida Building Code.

Definition of the Problem: Appliances, Lighting and MELs – those electronic devices not responsible for space heating, cooling, water heating, or lighting and excluding major appliances – comprise a significant portion of total home energy use. Thus, energy use reduction in these areas has great savings potential. An ongoing, detailed monitoring study by the Florida Solar Energy Center of 56 existing Florida homes ranging in vintage from 1955 - 2006 found lighting and MELs comprised 22% of total home energy use, and major appliances (refrigerators, dishwashers, ranges, and clothes dryers) comprised 17% [1]. The 2014 Florida Building Code has a prescriptive requirement in section 404.1 for a minimum of 75 percent of the lamps in permanently installed lighting fixtures to be high-efficacy lamps, however the extent to which this provision is enforced is unclear especially since it is easy for homeowners to replace lamps with less efficient models. There is no code applicable to appliances or miscellaneous electric loads.

While it is known that using higher efficiency components, such as those that are Energy Star labeled, will result in savings, there has been a marked increase in the number of components in use in new homes. In the previously mentioned study, over 50% of the homes were found to have second refrigerators or freezers. In newer homes, the inclusion of accent lighting for aesthetic reasons is on the rise. The characteristics of Florida energy code baseline homes for years 1979 through 2009 demonstrates the trend of increased MELs, while cooling, heating, and water heating energy use has substantially declined. (Fairey 2007). Our understanding of the energy consumption for a modern suite of MELs including home entertainment centers, game systems, home offices, etc. is limited. Some of the struggle comes from the difficulty of disaggregating this energy use from the total (which is easily measured), but another difficulty is the unknown quantity of fixtures, components, and devices that are operating in new homes.

[1] http://www.infomonitors.com/pdr/

Background:

In a 171 home monitoring study in Central Florida conducted over twelve years ago, FSEC found an average of 29 light fixtures in the households and a connected potential lighting load of 1.5 kW. The average fixture power was 60 watts. Lighting energy use estimates ranged from a low of 1,220 kWh to a high of 1,950 kWh per year (Parker 2002). The current FSEC study previously mentioned found similar energy use, with incandescents still the dominant bulb type. Figure 1 portrays the impact of a 95% bulb change-out from incandescents to CFLs at one site, where the lighting retrofit reduced lighting and other plug load energy use by more than 50% or about 4 kWh per day.

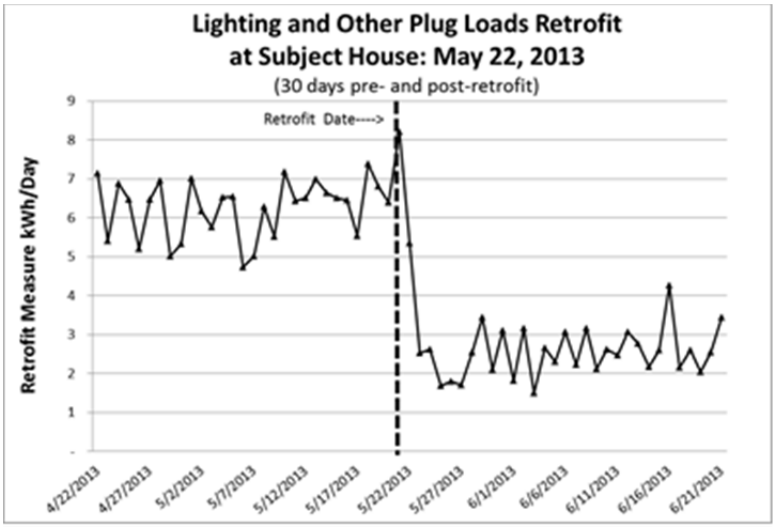

Figure 1. Site showing hourly lighting and other plug loads energy use, pre- and post- lighting retrofit.

In addition to consuming energy while in use, many MELs draw power while in a standby mode. Advanced power strips and other such devices that automate the process of switching unused equipment to a no power draw ("off") state have promising miscellaneous electric load savings, given people often do not take the time to unplug appliances when they are not being used (Bensch et al. 2010). FSEC's current existing home field study has found APSs to save as much as 256 kWh annually. However, many higher energy consuming home computer stations or entertainment centers were not able to be retrofitted with APSs because of the potential loss of functionality for some equipment.

Approach to the Research: The scope of this project is to conduct six months of detailed end use monitoring in 10 occupied homes built according to the 2010 Florida Building Code. Major energy end uses such as heating, cooling and water heating will be monitored individually, along with major appliances. Energy used for lighting and MELs will be determined by subtracting these major end use loads from the total house power. In addition, energy use for common collections of MELs, namely home office/workstations and entertainment centers will be

separately monitored. An audit will be performed to record the number of bulbs and fixtures, bulb types, and wattage, and to identify the appliance and MELs components and instantaneous power draws in their various modes. Occupant profiles and habits will also be documented. Findings will be compared to those from historical and ongoing field research in existing homes of widely-varying vintage.

Expected Outcome and Impact on The Code:

Research questions that expect to be answered include:

1. How much energy is actually used for appliances, lighting and MELS in newer homes, and what fraction of total energy use does it comprise?
2. How much efficient lighting are new homes receiving, and does it meet the 2010 code's 50% requirement?
3. What is the penetration of efficient components, such as those that are Energy Star labeled?
4. How does the energy use of appliances, lighting and MELS compare between newly constructed and older homes?

Answers to research questions will provide useful data in evaluating how lighting, appliances, and MELs might be addressed in future versions of the Florida Building Code. Results could potentially adjust baseline assumptions for energy used for lighting, appliances, and MELs in code compliance simulations. Findings could also serve as the basis for code credits that encourage reduction of lighting, appliance, and MELs energy use through use of efficient components, automation to reduce energy consumption, or reduced quantity of the components themselves.

Estimated Budget: $47,000

References:

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