Watt Watchers
Helping Military Housing Tighten the Belt on Energy Consumption

By Eileen Peppard, UH Sea Grant Sustainability Specialist

The University of Hawai‘i Sea Grant Center for Smart Building and Community Design, the School of Architecture, and the Hawai‘i Natural Energy Institute have teamed up to conduct energy audits on military housing managed by Forest City Military Communities Hawai‘i (Forest City). This interdisciplinary team, dubbed The Watt Watcher Team, was formed in 2010 to determine how energy is being used and to look for energy saving strategies. Forest City manages over 6,700 military houses in 37 neighborhoods on O‘ahu and Kaua‘i, so any energy saving measures adopted could add up to a significant reduction in power consumption.

The goals of the project are many to identify and quantify the end-uses of energy consumed by the homes, to determine what factors are contributing to high consumption, to provide recommendations to Forest City as well as to residents, and to provide data to consultants for building simulation studies to determine the best retrofit options. Interwoven in all this is an additional goal of improving the technical capacity of students and staff at the University of Hawai‘i at Mānoa.

The interdisciplinary Watt Watcher team includes students and staff from various schools and colleges throughout the university. The School of Architecture is involved in assessing the conditions of existing homes, such as air tightness and insulation of the building envelope. The data collected is used for computer simulation which is then used to formulate various options for retrofitting the structures.

College of Engineering students worked on electricity monitoring and managing data from energy audits. The Information and Computer Sciences team members are importing vast quantities of fine-grained historical metering data into a database for further analysis with their open source software, Watt Depot. Department of Economics team members will use the output from Watt Depot for their own analysis. All of the relevant data will be analyzed in a geographic information system (GIS) by a GIS expert from the Botany Department.

Another significant factor that comes into play is the change in the billing system for electricity for the residents. Traditionally, service members receive a basic allowance for housing that includes both rent and utilities combined. When a service member chooses to rent a home in one of the Forest City Military Communities (rather than renting in the private sector), they pay the entire allowance to Forest City without regard to how much electricity is used. In order to promote energy conservation, the Office of the Secretary of Defense mandated that all
Public Private Venture (PPV) housing starts a new system of billing for utilities. Hawai‘i and Beaufort/Parris Island, South Carolina were chosen as pilot sites to initiate this mandate. In conjunction with Hawai‘i’s Navy Region Commander, the partnership created the Resident Energy Conservation Program. Under this program, residents will be billed for the excess power if their consumption exceeds 20 percent over the average consumption for their peer group. The groups are broken down by neighborhood and house size. As residents conserve energy, the average consumption for the peer group goes down, making it more challenging for individual residents to stay in the non-payment zone. Residents consuming less than 20 percent below average receive a rebate. This type of billing creates accountability for excessive energy consumption while motivating residents to earn a rebate for significant energy conservation. Since Forest City is still paying the bill, their incentive for making energy improvements to the properties remains in place.

To date, the Watt Watcher team has conducted energy audits and monitored 30 homes. Electricity consumption for the entire house, air conditioner, water heater, clothes dryer and refrigerator was measured. Generally the air conditioner is the single largest electrical load in the house and can consume upwards of 60 percent of the total power consumption. Many factors can contribute to high air conditioning power consumption—thermostat setting, insulation levels, air leakage, compressor condition, other electrical loads producing heat in the home, and shading of the house by trees. The next largest power consumer in the home is generally the water heater.

In Hawai‘i, over 90 percent of our electricity is generated by burning fossil fuels, of which a large percentage is imported foreign oil. Building new, relatively energy efficient air conditioned homes is the easy part. Retrofitting existing buildings (many of which are inefficient due to being built during times of cheap oil) is the real challenge. This is where building simulation plays a role. Various retrofit options are modeled to determine if the simulation predicts an improvement in the performance of the building. Even if a home could be retrofit so it is equally efficient to a newly built, relatively efficient air conditioned house – is that good enough? Would 70 percent “less bad” be good enough? This is why involving university students is key to this project – they are not stuck in the old paradigm. Perhaps our goal should be to design buildings to be more like trees – providing shade, protection, allowing for breezes, and providing aesthetic benefits to the occupants. As Albert Einstein once said, “We can’t solve problems by using the same kind of thinking we used when we created them.” If we don’t set a higher goal, we won’t get there.