Unifying Home Asset & Operational Ratings: Adaptive Management via Open Data & Participation
FESC Project Update April 15, 2013

1. Project Description
   PI: Mark Hostetler (Associate Professor, UF Department of Wildlife Ecology & Conservation)
   Co-PI: Hal S. Knowles, III (Change Agent, UF Program for Resource Efficient Communities)
   Supported Student(s): Hal S. Knowles, III (Ph.D. Candidate, UF School of Natural Resources & Environment)

   External Collaborators: Nick Taylor (Ph.D. Student, UF School of Natural Resources & Environment), Jennison Kipp (Assistant In, UF Program for Resource Efficient Communities)

   Description/Abstract: Recent environmental, social, and economic challenges are fostering a wave of interest in maximizing energy efficiency and conservation (EE+C) in existing U.S. homes. Long standing programs, ratings, and metrics are being reapplied into new stimulus initiatives such as the *Recovery through Retrofit*[1] program. Simultaneously, electric and gas utilities are expanding their demand side management (DSM) programs from weatherization and conventional technology replacement incentives to include conservation behavior campaigns with "recommendation algorithms" designed to assist in homeowner energy retrofit decision making. Furthermore, loan programs are emerging to address the financial barriers that commonly limit initiation of the necessary retrofits.

   Collectively, these approaches most often project future home energy performance based on engineering models of the physical characteristics of homes (i.e., "asset ratings"). Yet to date, the marketplace is inadequately integrating historical household energy consumption patterns (i.e., "operational ratings") into the decision tree to optimize retrofit program efficacy and consumer benefits. Moving toward the unification of asset and operational ratings is crucial for successful program management, proper monitoring/measurement/verification (MMV), loan risk assessment, and for the persistence of reduced home energy use over time. However, unification will not be easy. This research project combines qualitative and quantitative research methods in social science and building science using Florida case studies to evaluate the opportunities and constraints of asset and operational rating unification and the steps necessary to get there. Relationships between our project and the collaborative, transparent, and participatory nature of "open government" initiatives are also being explored.

   Budget: $24,000 over two years ($12,000 from 01/01/2011 to 12/31/2011 and $12,000 from 01/01/2012 to 12/31/2012)

   Universities: University of Florida

   External Collaborators: Nick Taylor (Ph.D. Student, UF School of Natural Resources & Environment), Jennison Kipp (Assistant In, UF Program for Resource Efficient Communities)

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[1] See, http://www.whitehouse.gov/assets/documents/Recovery_Through_Retrofit_Final_Report.pdf

2. Summary of Progress Since October 1, 2012

The conclusion of the 2 years of this research project led to the submission of a supplementary proposal for additional funding from FESC for more in-depth research on the unification of building asset and operational rating systems. This request was awarded at a budget of $32,000 over 18 months (from 04/01/2013 to 09/30/2014) to cover a portion of the salary (at a rate of $22.20/hour) and fringe benefits (at a rate of 26.9%) for Co-PI, Hal S. Knowles, III. This equates to 36% (14.6 hours, or effectively 2 weekdays) of this Co-PIs weekly salary and fringe for the 18 month period.

This new supplemental research will expand on themes and insights gained through the first phase of this existing FESC project. Specifically, these insights suggest that even when adding operational data to building asset data, the reductionist approach to evaluating home energy performance by controlling for known variables may continue to offer an incomplete picture of the complexities of performance trends and the influence of unknown and/or misunderstood variables. Furthermore, the home improvement industry may need to consider the possibility that the magnitude of total energy consumption, while a worthwhile metric and with its net reduction a worthwhile goal, is also an incomplete indicator of home energy performance optimization.

As such, this new supplemental phase of our research will look at the nonlinear dynamics of residential energy consumption patterns as a new, complementary, more holistic methodology to detect homes that are performing poorly. First, a discrete nonlinear time-series analysis of high frequency smart grid energy consumption data will be performed for select samples of residential customers within multiple Florida utilities. It is hypothesized that the chaotic, nonlinear pattern inherent to this signal has diagnostic value (e.g., as if it's the heartbeat of the home) that may allow for utilities, local governments, institutions of higher education, and non-governmental organizations to better identify and provide energy assistance to homes based on the presence of either a "healthy" or a "diseased" beat. Second, the nonlinear consumption patterns of homes will be compared to weather indicators to determine whether energy consumption tracks changes in climatic variables. Third, for homes that have undergone home energy improvements, before and after changes in the nonlinear patterns of energy consumption are compared to see if the consumption signature more closely reflects the signature of climatic variables. These analyses will determine whether nonlinear analyses of home energy consumptive patterns are useful in detecting underperforming homes and the impacts of home energy improvements.

To date, we have submitted formal smart meter data requests from Talgov Utility Billing Services Division and JEA in Jacksonville. Both have responded favorably and we expect 30 minute, daily, monthly, and yearly energy consumption data for up to 400 homes. Hal Knowles has begun to explore nonlinear statistical analyses with home energy consumption data (R statistical package).

3. Funds Leveraged/New Partnerships Created

New collaborations		
Partner name	Title or short description of the collaboration	Funding, if applicable
Enes Hosgor (Carnegie Mellon University)	UF/PREC is in discussion with this potential collaborator on a variety of potential benefits from improved business incubation on home energy performance monitoring and consumer feedback tools and platforms.	Opportunities under consideration
EcoCity Partners	Active collaboration is ongoing in the development and submission of a grant proposal to the US DOE Better Buildings program.	Minimum of $50,000 over 3 years
FAIRWINDS Credit Union	As seeded by the Osceola Energy Initiative (OEI), an ARRA funded program, UF/PREC has entered a 10-year partnership with FAIRWINDS Credit Union to administer a 7-county, $5 million residential energy efficiency finance program.	Tied to revenue from the delivery of the loan program
Several Building Contractors	UF/PREC is currently building partnerships with building professionals to serve as "Participating Independent Contractors" in the loan program.	Tied to revenue from the delivery of the loan program

Proposal #1

Title	Agency	Reference Number	PI, Co-investigators and collaborators	Funding requested	Project time frame (1 year, 2 years, etc.)	Date submitted
The BEERE Menu: Pre-Packaged Technology Retrofit Options for PACE Financing	US DOE Better Buildings	DE-FOA-0000829 CFDA #: 81.086	PI: EcoCity Partners Co-PI: Hal Knowles, Craig Miller, Nick Taylor Collaborators: Pierce Jones and Jennison Kipp	$50,000 (tentative) (UF Subcontract portion on a $500,000 overall proposal)	3 year	Due April 24, 2013

Hal Knowles, Co-PI and the primary supported person on this FESC project was a University of Florida Program for Resource Efficient Communities (UF/PREC) point person and contributor to the development of this new proposal. UF/PREC proposed to provide the following major services as a subcontractor for this energy efficiency financing and retrofit program: (1) energy pre-screening; (2) retrofit package specification development and standardization; (3) quality control; and (4) measurement and verification. As summarized on the proposal abstract:

"This project seeks to accelerate commercial property assessed clean energy (PACE) financing by small commercial building owners. We will simplify pathways to project completion and finance by designing and offering standardized, pre-packaged technology retrofit options arranged by building type and size, business type, climate zone and other factors. We will prove the reliability of pre-project estimates of energy and cost savings through post-project audits, monitoring & verification. This will enable us to develop critical informational resources for building owners to select from a menu of options for buying energy-efficiency and renewable energy solutions (the "BEERE Menu").

Successful projects included in the BEERE Menu will generate a minimum of 20% energy savings and be capable of accurate estimation. This will facilitate scalability of small commercial energy-efficiency solutions using PACE financing by streamlining pre- and post-energy audit requirements, and will simplify underwriting, approval and financing. Finally, the project will facilitate easier aggregation of PACE projects for pooled financing arrangements. The results will be made available to other PACE program administrators through a white paper and an industry-targeted webinar.

Grants / Contracts Awarded #1					
Title	Agency	Reference Number	PI, Co-investigators and collaborators	Period of Performance	Funding awarded
Homeowner Energy Interactive Tool	Florida Department of Agriculture and Consumer Services (FDACS) Office of Energy	PO #: S-4200-A1553	PI: Nick Taylor Co-PI: Hal Knowles Internal Collaborators: Craig Miller, Jennison Kipp, & Pierce Jones External Collaborators: Acceleration.Net	3 months (from March 28, 2013 – June, 30 2013)	$34,650

Hal Knowles, Co-PI and the primary supported person on this FESC project was a major University of Florida Program for Resource Efficient Communities (UF/PREC) contributor to the development of this new proposal and will be a major contributor during the execution of the successfully awarded purchase order. UF/PREC, in support with an external IT partner (Acceleration.Net) is tasked to provide the following scope services:

1. Provide a web-based home energy self-audit survey and response tool to analyze a homeowner's present energy situation using already known or easily attainable information
2. Provide an interactive application
3. Identify resources to help the homeowner put recommendations into action
4. Host, maintain, and troubleshoot the interactive website for one year to ensure a functional product
5. Provide project management services for the design, testing, implementation, and project closure that include, but are not limited to scope, management, risk management, a communication plan, quality assurance, and change management