



TIP 327: NILM Accuracy Test Standard Development and Measurement Improvement

Context

Energy audits are critical in conveying what and why to improve homes and are often critical to financing home performance improvements, but they are expensive and intrusive. Emerging **nonintrusive load monitoring (NILM)** technologies offer tremendous advantages for measurement and verification (M&V) of building performance. These technologies may dramatically reduce costs in load research, program evaluation, and building operations. NILM offers the option for continuous commissioning of EE systems (new or retrofit).

Establishing accurate disaggregated load profiles for buildings without the need to install and maintaining traditional monitors may be most valuable for reaching dispersed markets, such as small commercial and residential buildings. These are expensive to assess due to total numbers and difficult to motivate action in due to the lack of trained decision makers. As an enabling technology, NILM is critical to smart grid and transactive control approaches.

Description

This project is divided into two phases. Phase 1 will concentrate on the following:

- Improve and standardize current test protocols to measure the accuracy of non-intrusive load monitoring (NILM) intended for the disaggregation of residential loads,
- Continue the PNNL Lab Home platform to support ongoing NILM evaluation, and
- Test and report the accuracy of evolving NILM technologies based on a recognized standard protocol in the Lab Home environment.

Testing protocols will be based on ongoing work at PNNL, but utility and industry input will be crucial. PNNL intent is to develop a publicly shared protocol that will be widely accepted and used for consistent NILM product evaluation and comparison. This will require consultation with industry, utilities, and researchers.

In phase 2, the goal is to develop a low-cost and robust technique to improve the accuracy of measuring energy usage of large equipment in buildings. This phase will

include the development and prototyping of an “appliance magnet” sensor to more accurately distinguish the run times of large energy appliances based on the vibrations resulting from motor operation. A current NILM vendor has agreed to work with PNNL on this project and a letter of interest is attached at the end of this proposal.

Why It Matters

NILMs are an emerging technology with tremendous potential value to electric utilities and energy managers. Establishing accurate load profiles for buildings without the need to install and conduct traditional monitors would impact utility planning and operations, and energy management.

Potential benefits of low-cost and reliable NILMs include:

- improved and simplified load studies including the identification of specific end-use candidates for demand response and energy efficiency,
- identification of high-value targets (neighborhoods, facilities, or individual buildings) for efficiency and demand response programs,
- new options for diagnosing end-use equipment, and
- lower-cost measurement and verification (M&V) of installed measures

Goals and Objectives

The project objective is to increase understanding of - and improve the proficiency of - NILM technologies and to develop a publicly available test-standard protocol for consistent NILM assessment.

Deliverables

The project deliverables will include: Project Management Plan including Communication Plan; Appliance operating schedule; Documentation of Equipment Installation in the Lab Homes; Current Inventory of Commercially Available or Beta Form NILMs and an inventory of NILM equipment installed in the Lab Homes; Report of NILM Accuracies from Test Protocol; Lessons Learned Document; Stakeholder Webinars; Conceptual model of appliance sensor; Final Report

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Project Start Date: October 1, 2014

Project End Date: September 30, 2016

Reports & References (Optional)

Links (Optional)

Funding

Total Project Cost:	\$800,000
BPA Share:	\$400,000
External Share:	\$400,000
BPA FY2015 Budget:	\$200,000

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