Programs for the Montreal Meeting (June, 2011):

Technical Paper Session 1 (Advanced)
Sunday, June 26, 2011, 8:00 AM-9:30 AM

Getting the Most Out of Building Energy Assessments
Track: *Commissioning*
Chair: *Sarah E. Maston, P.E., Member, Advanced Building Performance, Hudson, MA*

The papers in this session present methodologies and techniques for estimating potential energy savings from building-commissioning and by conducting building energy audits or assessments.

1. The Nearest Neighborhood Method to Improve Uncertainty Estimates in Statistical Building Energy Models (ML-11-001)
Lei Yafeng, Ph.D., P.E.[1], T. Agami Reddy, Ph.D., P.E., Fellow ASHRAE[2] and Kris Subbarao, Ph.D., Member[3], (1)Nexant, Inc., Houston, TX, (2)Arizona State University, Tempe, AZ, (3)Pacific Northwest National Laboratory, Richland, WA

Accurate estimation of uncertainty in energy use predictions from statistical models finds applications in a number of diverse areas of interest to building energy professionals. Some examples are in the determination of measured energy savings in monitoring and verification (M&V) projects, in continuous commissioning and in automated fault detection wherein improper building or equipment performance are to be detected. All these applications generally involve identifying a baseline statistical model representative of energy use prior to the retrofit (or to energy use under fault-free operation), and then ascertaining the energy savings (or the penalty for faulty operation) as the difference between the measured post-retrofit energy use and the corresponding model-predicted value. Unfortunately, the model residual outliers are ill-behaved and estimates of the uncertainty in the energy savings tend to be unrealistic. Developing a general methodology for determining more realistic, robust and credible estimates of the uncertainty in energy savings would be of great value, and this is the objective of this paper.

The proposed approach is to determine the uncertainty from "local" system behavior rather than from global statistical indices of the model fit such as root mean square error and other measures as is the current practice. This is done using the non-parametric nearest neighborhood points approach which is well known in traditional statistics. The methodology is applicable to any type of statistical model approach such as regression, time series, neural networks, and could be coded into a computer package that can be appended to existing M&V analysis programs. Two case study examples using daily building energy use data serve to illustrate the proposed methodology. The ultimate benefit of such a reliable and statistically defensible method is to lend more credibility to the determination of risk associated with energy savings from energy efficiency projects,

and thereby induce financial agencies to become more involved in “white tag” and allied certification programs.

2. Energy Assessments of Building Sites: Methodology and Techniques (ML-11-002)

Alexander Zhivov, Ph.D., Member[1], Jorma Pietilainen, Associate Member[2], Fritz Schmidt, Dr.Ing.[3], Erja Reinikainen[4] and Alfred W. Woody, P.E., Fellow Life Member[5], (1)U.S. Army Corps of Engineers, Champaign, IL, (2)VTT Technical Research Centre of Finland, Espoo, Finland, (3)Ennovatis GmbH, Tunnelstrasse 14, Germany, (4)Olof Granlund Oy, Heksinki, Finland, (5)Ventilation/Energy Applications, PLLC, Norton Shores, MI

Analysis of nonresidential building structures shows that many buildings of this type are characterized by high energy consumption. Administrative/office buildings and production and maintenance facilities pose specific challenges to those seeking improved energy management and building energy performance. Common to all these buildings is that questions of energy consumption are generally seen as secondary to the improvement of comfort and/or functionality. This is most pronounced within the existing building stock. Decisions to retrofit a building are often made because of dissatisfaction concerning the comfort level, or as a consequence of changes in building use or in processes performed in the building. The primary goal of the retrofit is to improve these conditions. Good technologies that meet these requirements are currently available. The objectives of the International Energy Agency Energy conservation in Buildings and Community Systems (ECBCS) Programme Annex 46 is to provide tools and guidelines to identify energy conservation opportunities in buildings and to improve the indoor environment of these buildings in energy-efficient retrofitting projects. Among tools developed within this project is the Energy and Process Assessment Protocol, which provides an energy assessment methodology and procedure suitable for different types of sites, including a variety of different non-industrial buildings with energy requirements dominated by climate and industrial buildings, which have high energy loads dominated by internal processes and high ventilation requirements per its floor space. This paper presents the energy assessment methodology for a single building or a large building stock, along with examples of typical energy wastes and inefficiencies in different types of buildings and typical processes.

3. Establishing Building Recommissioning Priorities and Potential Energy Savings from Utility Energy Data (ML-11-003)

Kevin P. Hallinan, Ph.D.[1], Phil Brodrick, Student Member[1], J. Kelly Kissock, Ph.D., P.E., Member[1], Robert J. Brecha, Ph.D.[1] and Jessica Nothridge, Student Member[1], (1)University of Dayton, Dayton, OH

An energy reduction program for commercial buildings is implemented for a SW Ohio natural gas utility. The aim of this study is to demonstrate that historical utility data for individual building customers, along with knowledge of pertinent building information (square footage, year built, number of floors, height of floors, wall construction type, and use type) available in County Auditor databases, could be used to identify the best candidate buildings for recommissioning in terms of energy savings and simple payback.

A study is completed for all natural gas customers of a utility in Montgomery and Clinton Counties in Ohio. A total of 1200 candidate buildings for recommissioning are identified. These buildings have: i). seen increases in heating or non-weather dependent energy over time; or ii). have large baseline energy intensities indicative of combined heating/cooling year round. For these buildings, individual energy reports are created and shared with the building owners. For a subset of buildings, on-site recommissioining evaluations were used to confirm estimates derived from utility data alone.

Seminar 10 (Intermediate)
Sunday, June 26, 2011, 11:00 AM-12:30 PM

Commissioning: New Buildings without It and at an Existing Major Airport Terminal
Sponsor: *7.9 Building Commissioning*
Track: *Commissioning*
Chair: *Mike Eardley, P.E., Member, Cannon Design, Boston, MA*

One presentation describes the faulty performance of a private school, three new schools in a suburban school district, and a hospital. In each case the mechanical systems did not operate per the owner's requirements and failed to provide the proper occupancy conditions. The other presentation addresses how energy savings with under a two year payback was accomplished at an airport terminal and what measures were effective through existing building commissioning.

1. Existing Building Commissioning of a Major Airport Terminal
Guanghua Wei, Energy Systems Lab at Texas A&M University, College Station, TX

2. Case Studies of the Problems and the Solutions of New Buildings without Commissioning
Gerald J. Kettler, P.E., Life Member, AIR Engineering and Testing, Dallas, TX

This presentation describes the faulty performance of a private school, three new schools in a suburban school district, and a hospital. In each case the mechanical systems did not operate per the owner's requirements and failed to provide the proper occupancy conditions. In the hospital case, it severely damaged the air handler. All three cases involved both design and construction issues.