ASHRAE GUIDELINE

Measurement of Energy and Demand Savings

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b. participation in the next review of the Guideline,
c. offering constructive criticism for improving the Guideline,
d. permission to reprint portions of the Guideline.

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ASHRAE Guideline 14-2002, Measurement of Energy and Demand Savings

(This foreword is not part of this guideline but is included for information purposes only.)

FOREWORD

Guideline 14 was developed by ASHRAE to fill a need for a standardized set of energy (and demand) savings calculation procedures. The intent is to provide guidance on minimum acceptable levels of performance for determining energy and demand savings, using measurements, in commercial transactions. Note that it is entirely possible to have a sale/purchase, lease, or other arrangement for energy-efficient equipment that does not involve measurements. Indeed, the vast majority of transactions are of this type. However, if the savings determination is to be based on measurements, certain minimum requirements are necessary in order to avoid a process that appears to be based on actual savings but might be highly inaccurate, biased, or random.

It is expected that ASHRAE Guideline 14 will be used for transactions between energy service companies (ESCOs) and their customers and between ESCOs and utilities, where the utilities have elected to purchase energy savings. Use of ASHRAE Guideline 14 is expected to provide savings results sufficiently well specified and reasonably accurate so that the parties to the transaction can have adequate assurance for the payment basis. Other applications of ASHRAE Guideline 14 may include documenting energy savings for various credit programs, e.g., emission reduction credits associated with energy efficiency activities.

Determining savings with measurements in accordance with this guideline involves measuring post-retrofit energy use and comparing that to the measured pre-retrofit use, adjusted or normalized, to act as a proxy for the conditions that would have prevailed had the retrofit not been performed. Therefore, determining energy savings through the use of measurements involves more than just verifying that new equipment has been installed and can function as expected, although those tasks are usually a necessary part of determining savings. In addition, energy savings cannot be claimed to be "measured" if no pre-retrofit data are available.

Sampling is often used in projects involving end-use monitoring or what we call the "retrofit isolation approach." Annex B gives procedures to calculate the added uncertainty due to sampling. ASHRAE Guideline 14 may be used to measure the energy savings from a utility sponsored or contracted multiple-building energy conservation project. Applying ASHRAE Guideline 14 to such a project would allow the use of Annex B to calculate the measurement uncertainty directly. The net impacts of large-scale utility energy conservation programs, such as those that may involve market transformation or standard offers for purchase of conservation energy, are specifically excluded from the scope of ASHRAE Guideline 14, although individual and multiple-building projects within such programs are covered.

ASHRAE Guideline 14 primarily addresses measurements of energy and demand for determining savings. Other tasks are needed in any energy performance contract. These can include determining appropriate utility rates, inspecting and commissioning equipment, etc. Users of ASHRAE Guideline 14 who are interested in learning more about some of the contractual issues and types of performance contracts will find relevant discussion in the DOE publication "International Performance Measurement and Verification Protocol" (IPMVP 2000) available at <www.ipmvp.org>.

1. PURPOSE

The purpose of this document is to provide guidelines for reliably measuring the energy and demand savings due to building energy management projects.

2. SCOPE

2.1 This guideline provides for using measured pre-retrofit and post-retrofit data to quantify the billing determinants (e.g., kWh, kW, MCF, etc.) used for calculation of energy and demand savings payments to energy service companies, utilities, or others.

2.2 ASHRAE Guideline 14 includes the determination of energy and demand savings from individual facilities or meters.

2.3 Procedures include all forms of energy, including electricity, gas, oil, district heating/cooling, etc.

2.4 The procedures encompass residential, commercial, and industrial buildings.

2.5 The procedures do not include

a. sampling methodologies that may be used in large-scale demand-side management programs,
b. metering standards, or
c. major industrial process loads.

3. UTILIZATION

3.1 Basic Methodology

There is no direct way of measuring energy use or demand savings since instruments cannot measure the absence of energy use or demand. However, the absence of energy use or demand can be calculated by comparing measurements of energy use and/or demand from before and after implementation of an energy conservation measure (ECM). Simple comparison by subtraction of post-retrofit energy use from the pre-retrofit quantity does not differentiate between the energy impacts of the ECM and those of other factors such as weather or occupancy. In order to assess the effectiveness of the ECM alone, the influence of these other complicating factors, such as weather and usage factors, must be removed.

This guideline addresses determination of energy savings by comparing before and after energy use and making adjustments for non-ECM changes that affect energy use. The basic method of this guideline is shown in Figure 3-1. It involves projecting energy use or demand patterns of the pre-retrofit (baseline) period into the post-retrofit period. Such projection requires adjustment of baseline energy use or demand to different conditions of weather, occupancy, or other energy-governing variables. Savings are then determined as:

Savings = (Baseline energy use or demand projected to Post-retrofit conditions) minus (Post-retrofit energy use or demand)